THE FOUNDRY

Volume 53
Number 9

CLEVELAND, OHIO, MAY 1, 1925

Published
Semimonthly

Castings Going Up as Interest in Aviation Grows

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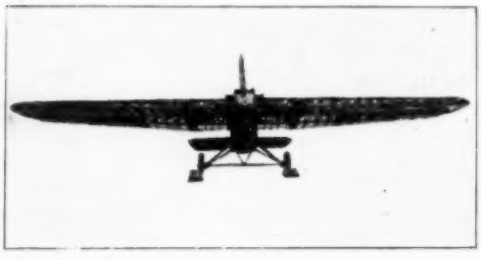

Metal Framework of a Three Passenger Navy Plane

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Find Where Castings Can Be Sold

CONTENTS

A Good Conversationalist Is One Who Lets You Talk 343

Use Special Molding Machines for Farm Castings—By Pat Dwyer 345

Sells Castings By Stressing Quality Rather Than Price 349

Makes Castings for Water Works 350

Making Hard Manganese Steel—By Hubert Hermanns and Hermann Meixner 356

Refining Metals Electrically—By Larry J. Barton 359

Apply Test Methods To Aid in Controlling Sand in Foundries—By H. W. Dietert 361

Bill Talks on Deferred Redress—By Pat Dwyer 367

Who Is Responsible for Porous Castings—By James A. Murphy 371

Simplifying Standard Shapes and Sizes 373

How and Why in Brass Founding—By Charles Vickers 370

Milestones in Foundry Progress 375

The Shakeout 376

Trade Outlook in the Foundry Industry 377

Comings and Goings of Foundrymen 378

Equipment Market 383

What the Foundries Are Doing 384

New Trade Publications 384

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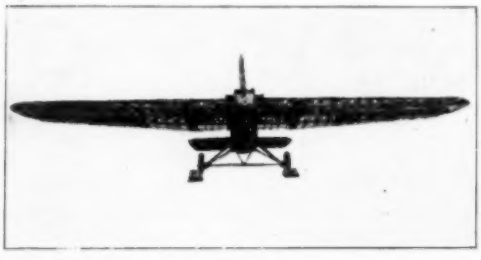

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Use Special Molding Machines *For Farm Castings*

By Pat Dwyer

Fig. 2—Small individual benches are mounted on wheels so that the molder may follow his diminishing sand pile

EVEN if a manufacturer decided that his product was perfect and in that belief, sat back content to go on in an established rut, modern industrial conditions quickly would force him to change his mind either by crowding him off the broad highway of the world's business, or by supplying a pacemaker that would keep him up on his toes. The great majority of manufacturers usually have a more powerful incentive, one that strikes down and grips the bedrock of human nature, a commendable desire to occupy a place in the vanguard rather than in the mediocre crowd in the center or among the stragglers bringing up the rear. The Massey-Harris Co., Toronto, Canada, manufacturer of agricultural machinery is no exception to this general rule. While it is true that the company turns out a vast quantity of standardized pieces of equipment in which the castings made in May resemble those made in December as closely as the peas in one pod resemble the peas in a second pod on the same vine, still modifications are introduced from year to year. The product of one year will differ slightly from that of the preceding year and the points of difference accumulated over a 10-year period are as extensive as those noticeable between an automobile of the present day and one of the vintage of 1915. The company maintains a research and experimental department engaged constantly in developing and designing new types of agricultural machinery and in changing or installing new features on types of machines that are regarded as more or less standard. Representatives in the field, both domestic and foreign, constantly are investigating conditions with a view of increasing the efficiency of existing machinery or

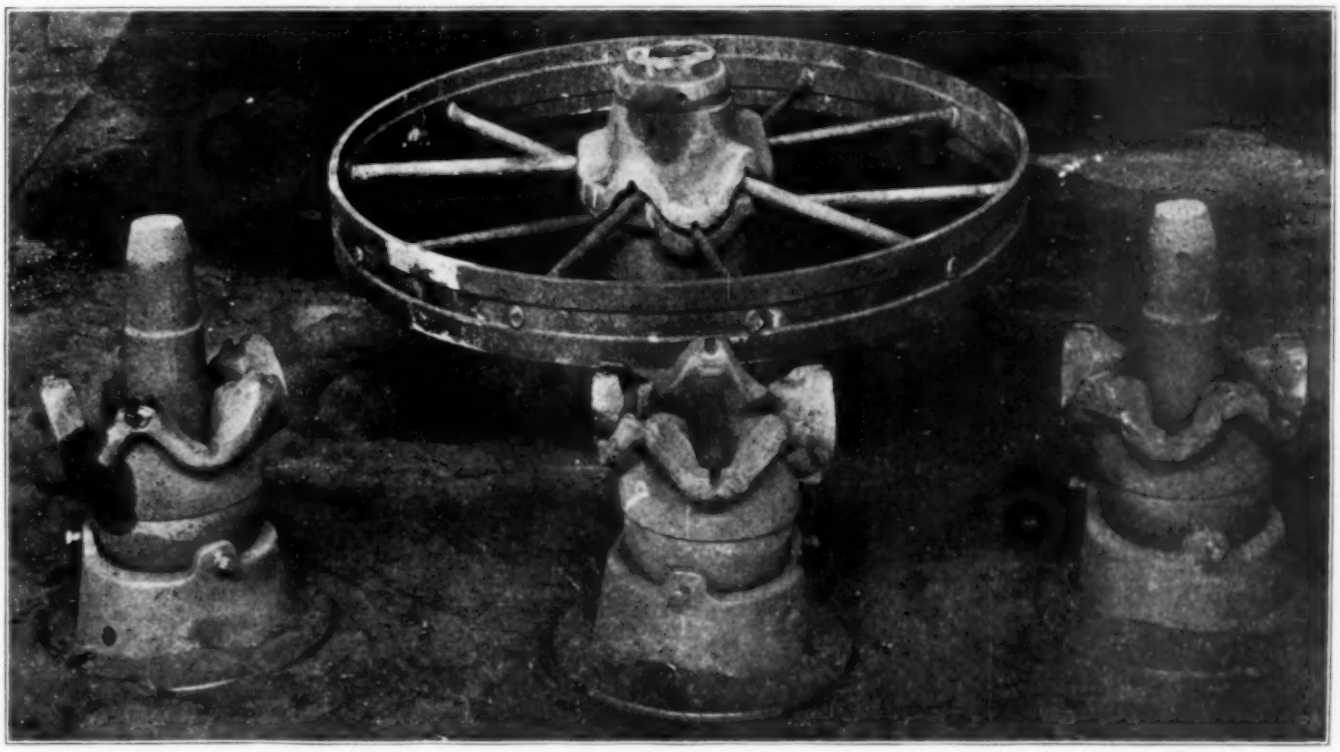


FIG. 1—THE USUAL SPLIT CORE METHOD OF ATTACHING CAST IRON HUBS TO STEEL WHEELS HAS BEEN SUPERSEDED BY A SET OF PERMANENT IRON MOLDS MOUNTED ON SUITABLE FOUNDATIONS—THE IRON MOLD AUTOMATICALLY CENTERS AND SUPPORTS THE STEEL WHEEL IN POSITION

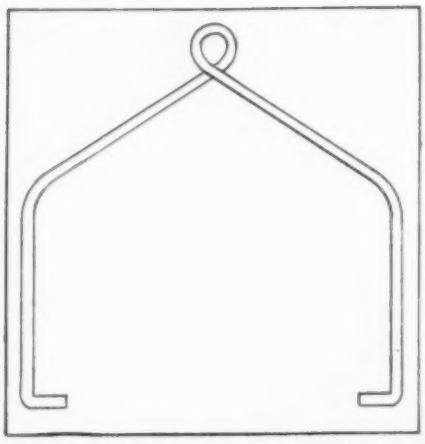


FIG. 3—SPRING BAIL HOLDS TOES IN PLACE

of designing special machinery to supplant laborious hand methods.

Molds for castings for this class of work together with short orders of various kinds and miscellaneous repair parts are made on benches after the manner pursued in the ordinary jobbing shop. However, the benches are mounted on wheels as may be noted by referring to Fig. 2 and as a result the molder merely has to lift the mold from the bench to the floor instead of having to carry it from the back to the front of the floor. The bench straddles the sand heap and is moved steadily from the front to the back of the heap as the day's work progresses and as the sand is transferred from the heap to the rammed flasks. This arrangement cuts out all extra and lost motion, relieves the man of a great deal of extra walking and lifting and results in a proportionately larger output of good castings.

Placed on Machines

After a design has been adopted as standard—that is standard at least for a limited period—a different method is followed to secure maximum production. In the first instance a temporary wood pattern is employed and no particular attempt is made to establish a peak record on the number of castings produced in a given period of time. In fact before the experimental run is finished the pattern may be changed in some respects and it is almost certain to predict that the style and method of gating will be changed in some particular from the original layout. However, once the standard has been established no further changes are made for at least a considerable period and the job is handled on a production basis.

The experimental run in the hands of skilled operators and under competent supervision demonstrates the best available method for producing the casting and a sufficient number are made to try out the efficacy of short cut methods. With these points established, suitable metal patterns and equipment are prepared and men, both skilled and semi-skilled are placed on the machines. Many men have been in the employment of the company for many years and have become particularly skillful in the operation of the equipment provided. Usually each man specializes in the production of one casting or of one type of casting. He developes an intensive and intimate

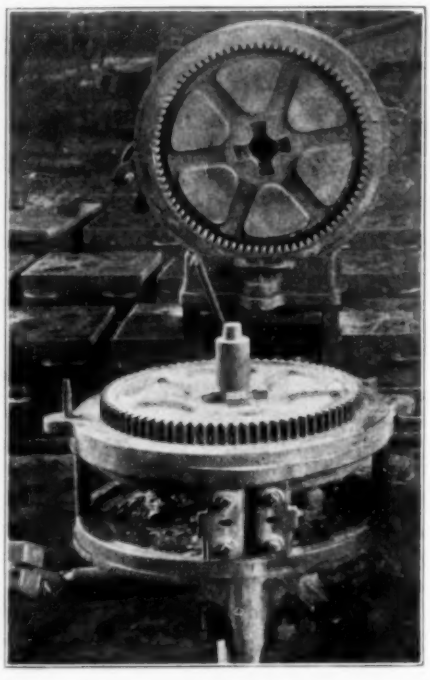


FIG. 4—GEAR PATTERNS ARE MOUNTED ON STRIPPING PLATES

knowledge of all the little tricks and short cut methods and naturally attains a record of production above the average after a certain length of time. In common with several other branches of the foundry business, alternate periods of depression and activity mark the output of harvesting machinery and this necessitates hiring a large number of extra men during the busy season. While some of the men may be skilled or may have had foundry traning to some extent formerly, the great majority are drawn from that polyglot class known as unskilled labor, men who never have had any definite training along any particular line. At the beginning of the season a definite output of castings is scheduled to synchronize with the anticipated production of finished machines and to meet this schedule it is imperative that the recruits be whipped into shape as rapidly as possible.

Maintain School of Instruction

A special department under the supervision of a competent instructor is maintained for this purpose where each man receives special and personal attention and advice tending toward the rapid and economical production of one type of casting. Machines and auxilliary equipment all are designed with the same end in view and consequently if the candidate is blessed with only a fair to middling share of intelligence, he has no difficulty in blossoming out as a skilled operator in a short time. Occasionally a hopeless derelict drifts in, but he either is dropped after a short trial or is given a job where neither mental nor physical dexterity are regarded as necessary qualifications.

In this respect it is interesting to note that some men take more readily to one type of machine or job than another. Some men naturally are heavy handed while others have a light

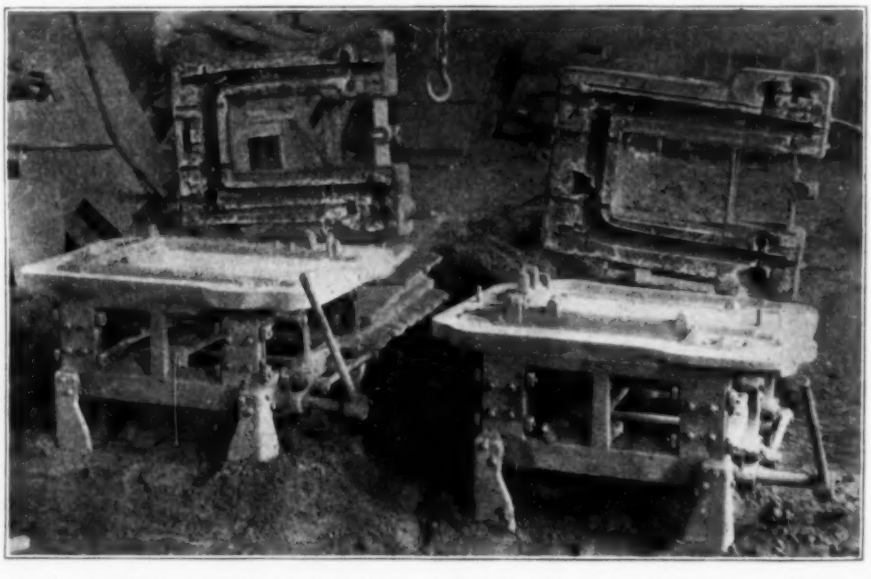


FIG. 5—SPECIAL FLASKS CONFORMING CLOSELY TO THE SHAPE OF THE PATTERNS REDUCE THE AMOUNT OF SAND TO BE SHOVELED AND RAMMED

and delicate touch. This feature readily is discernible to the instructor after a few trials and sometimes in extreme cases on the first trial. As nearly as possible the men are assigned to tasks where their special qualification will be brought into play.

Home Made Machines

Without exception the various patterns are mounted in a manner that will facilitate molding on the extensive battery of machines, a few supplied by outside interests, but the majority made in the company's own shops. They are designed and constructed to meet the peculiar conditions obtaining in the foundry, and in accordance with the specifications laid down by the foundry superintendent. The closest co-operation is maintained between the engineering department, the pattern shop and the foundry and as a result the machines are accepted and operated with a minimum of friction and without the buck passing usually observed in places where there is lack of co-operation or divided authority.

Many of the machines are of the plain squeezer type with or without pattern drawing or stripping plate attachment. In others the machine simply serves as a pattern mount and a pattern drawing device. The sand is rammed in the flask either with hand rammers or rammers operated by compressed air. Several of these machines with patterns in place and with open molds in the immediate vicinity are shown in Figs. 4, 5, 6, 7 and 8. The machines for the larger castings are located in one of the side bays of the foundry equipped with air operated traveling cranes.

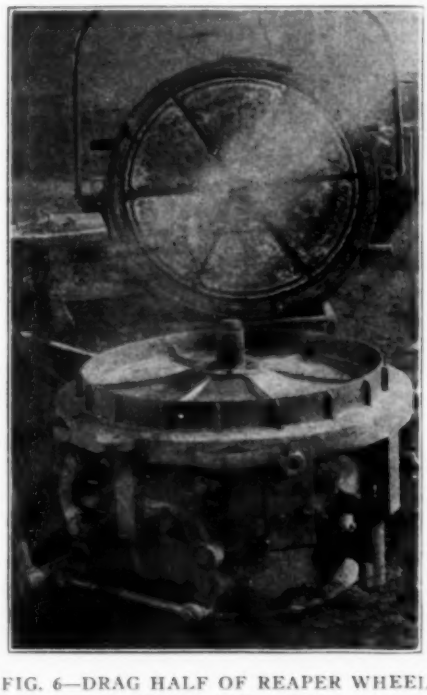


FIG. 6—DRAG HALF OF REAPER WHEEL PATTERN AND MOLD

The flasks conform closely to the shape and size of the patterns they are designed to cover. This feature is particularly noticeable in Fig. 5, illustrating the pattern equipment and a mold for a binder frame casting. The flask frame not only follows the contour of the pattern on the outside but also conforms to it closely on the inside. It is apparent that the amount of sand required to fill this flask is considerably less that the amount required to fill a flask of the ordinary rectangular type in which the entire space must be packed full of sand. The flask is provided with handles on each end so that it may be handled while empty by two operators. A hollow trunnion at each end furnishes a

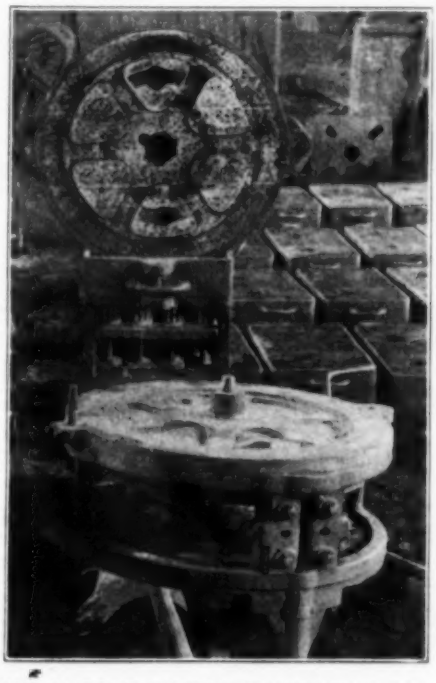


FIG. 7—COPE MAKING EQUIPMENT FOR GEAR SHOWN IN FIG. 5

ready means for attaching the ends of a spring bail suspended from the crane when it becomes necessary to lift the flask filled with sand. A 1-inch round steel bar bent as shown in Fig. 3 possesses sufficient spring to hold the toes firmly in the trunnion openings without at the same time offering undue resistance to an effort to release the toes when necessary. It seems to serve its purpose admirably and is a decided improvement over the usual type of horizontal beam equipped with a pair of slings either loose or permanent.

Patterns Are Stripped

Sand is rammed in these flasks by hand. The pattern is made in halves with the halves mounted on adjoining plain stripping plate devices so that

FIG. 8—REAPER WHEELS ARE POURED THROUGH THREE RUNNERS LOCATED BETWEEN ALTERNATE ARMS IN THE COPE

two operators may prepare both halves of the mold simultaneously. With the equipment shown two men make 54 molds including the setting of 3 large and 19 small cores in each mold. The same crane employed for handling the flasks also serves to shift the molding devices from point to point on the floor as the day progresses. This mold forms one of the exceptions to the almost universal rule of pouring the castings with hand ladles. It is poured through a single runner and two flat gates at one end in the cope as may be noted by referring to the illustration of the mold part shown to the left in Fig. 5.

Describes Pattern Equipment

Pattern equipment and typical halves of a mold for a reaper wheel are shown in Fig. 6 and 8. The pattern is prepared in two parts one for forming the cope impression Fig. 8 and one for the drag Fig. 6. This form of construction is necessary on account of the traction grips on the outside of the rim. These projections appear in staggered formation on the completed wheel, those on one side of the center line being located opposite the center of the space between two projections on the other side. This point will be more readily apparent by noting the position of one of the projections in relation to the guide lug on the pattern plate and comparing it with the position of a projection with the guide lug on the other plate.

The wheel as may be noted by referring to Fig. 8 is poured throug

three runners set between alternate pairs of arms. Each runner supplies two gates connected to the arms at the point of junction with the rim. This system of gating provides an even and rapid distribution of the metal and also equalizes the cooling strains set up while the wheel is contracting. The entire gating system is located in

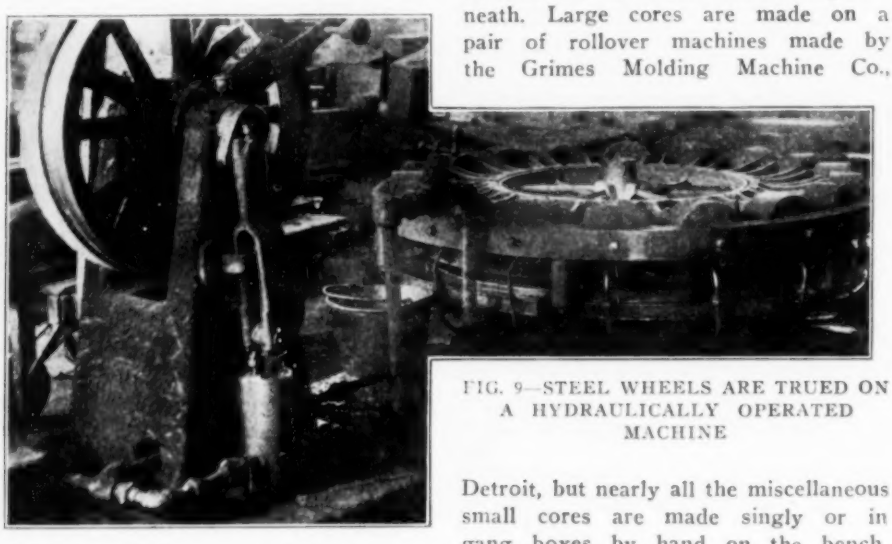


FIG. 9—STEEL WHEELS ARE TRUED ON A HYDRAULICALLY OPERATED MACHINE

the cope. The same method is employed on the gear wheel mold shown in Figs. 5 and 7.

Cast iron hubs are attached to steel wheels in a set of permanent iron molds shown in Fig. 1. Several sets of the molds are provided to form the hubs on wheels of different sizes. The assembled rim and spokes is adjusted in place while the mold is open as shown in the center. The center core made of sand in the usual manner is set as shown to the right and left and finally the top part of the mold is placed in position when the assembled mold will appear as shown at the back. The molds are placed in the oven over night so that they may be warm and dry when the first hub is poured. They are oiled lightly for the initial cast, but receive no further special attention afterward. They are poured, dumped, re-assembled and poured again continuously all the time the iron is running from the spout of the cupola.

The wheels are set approximately central in the hub casting device but afterward the rim is trued accurately in relation to the hub in the hydraulically operated device shown in Fig. 9. The opening in the hub is placed over a center on the table and the rollers on the outside massage the rim to a true circle concentric with the hub.

The core room occupies three stories at one end of the main building. This is exclusive of the basement which as stated before extends under the greater part of the foundry building. Sand is conveyed on a bucket elevator from the basement to the top floor where it is mixed with an oil binder and prepared for the coremaker's use in a revolving type mixer made by the Standard Sand & Machine Co., Cleveland. From the top floor the sand is fed through suitable chutes to the various machines and work benches on the floor immediately beneath. Large cores are made on a pair of rollover machines made by the Grimes Molding Machine Co., Detroit, but nearly all the miscellaneous small cores are made singly or in gang boxes by hand on the bench.

After the cores are placed on the plates they are loaded on racks and pushed into a battery of oil fired ovens. The racks are equipped with flanged wheels instead of the usual type employed where the racks are designed to be handled by lift trucks. In this instance tracks are laid on the core room floor and also in the ovens. A transfer car operating on a depressed track is utilized to shift a rack of cores from any track on the floor to any designated one of the ovens. On account of the comparatively small size of the cores they dry rapidly and as a result core racks constantly are either entering or leaving the ovens. Dried cores are stocked on the main floor and are distributed daily to the molding floors as required. Space on the various core room floors that is not required for any coremaking operations is utilized to store molding machines temporarily out of commission and other spare parts of foundry equipment.

Castings are cleaned in a large room the full width of the main building and separated from it at one end by a brick partition wall. This department is equipped with one rotary sandblast device made by the Pangborn Corp., Hagerstown, Md., and 30 tumbling barrels supplied by the W. W. Sly Manufacturing Co., Cleveland all suitably piped to a dust arrester that keeps the atmosphere reasonably clean at all times. Castings are shifted from point to point and finally into the basement on hand operated trucks, similar to those shown in Fig. 10.

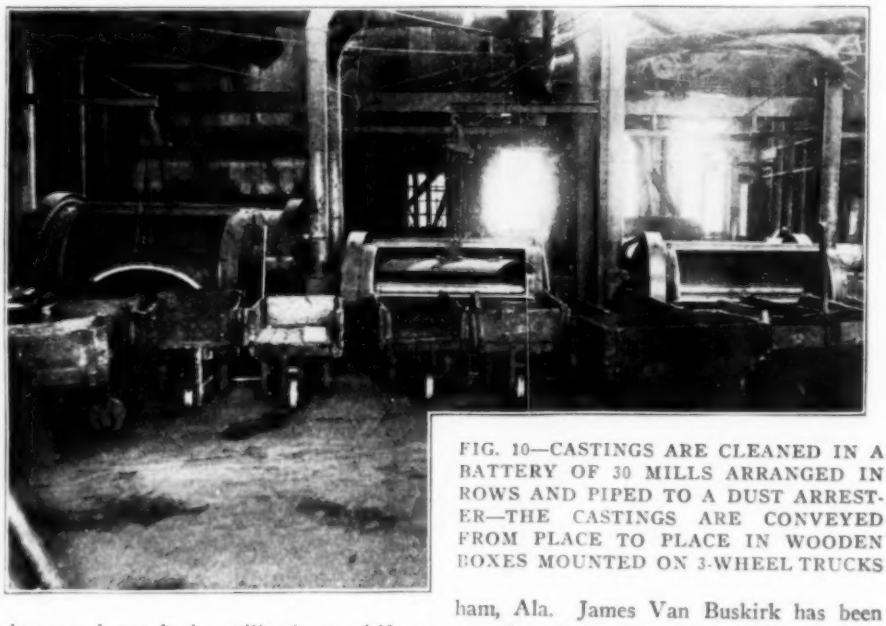


FIG. 10—CASTINGS ARE CLEANED IN A BATTERY OF 30 MILLS ARRANGED IN ROWS AND PIPED TO A DUST ARRESTER—THE CASTINGS ARE CONVEYED FROM PLACE TO PLACE IN WOODEN BOXES MOUNTED ON 3-WHEEL TRUCKS

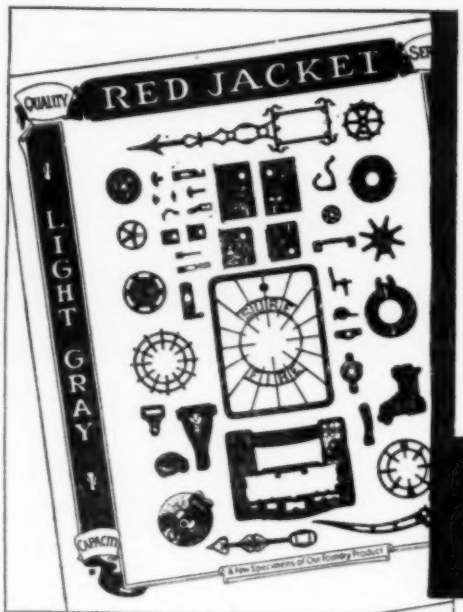
Holds Spring Meeting

The forty-seventh meeting of the American Electrochemical society was held at Niagara Falls, N. Y., April 23, 24 and 25. The fall meeting of the society will be held at Chattanooga, Tenn., Sept. 24, 25 and 26.

Opens New Office

The Harnischfeger Corp., Milwaukee, has opened a new branch office at 431 First National Bank building, Birmingham, Ala. James Van Buskirk has been transferred from the Detroit office of the company to take charge of the new office. H. E. Mensch, has recently been placed in charge of the Detroit office of the Harnischfeger company, 452 Book building.

Sells Castings by Stressing *Quality* Rather Than *Price*



Red Jacket Manufacturing Co—
DAVENPORT, IOWA, U. S. A.

BY COMBINING the manufacture of pumps and gray iron castings, the Red Jacket Mfg. Co., Davenport, Ia., keeps its plant running practically continuously. Salesmen and trade literature, as illustrated on this page, are used to place the product of the foundry before the trade, some of the methods of selling being related as follows by an officer of the company:

It is quite necessary to sell the output at a profit. We have found the best way to sell castings is to make a class of work that the average foundry will not touch stressing *quality* hard and developing customers who are more interested in quality than in price. The advertising from satisfied customers is extremely valuable at all times.

(*Concluded on Page 374*)

July 8th, 1924.

Red Jacket Mfg. Co.,
Davenport, Iowa.

Gentlemen:

We are very glad of this opportunity to tell you our views concerning Red Jacket castings.

We have always found your castings of a very fine, soft grade, readily machined and very accurate as to size. Our three suits have always been exceptionally low and we have had very little complaint from our goods when made from your castings.

We would be very glad at any time to be able to recommend Red Jacket castings to any prospective customer of yours.

With kindest personal regards, we are

Very truly yours,

COOPER MANUFACTURING COMPANY

July 8th, 24.

Red Jacket Mfg. Co.,
Davenport, Iowa.

Gentlemen:-

In reply to Mr. Lafferty's letter of the 7th inst, are pleased to state that the castings and service extended by your Company has been uniformly good, and our business relations with you have always been very pleasant, for this reason when we have new patterns to place we naturally think of the Red Jacket Mfg. Co.

Wishing you the success you deserve,

we are,

Montrose, Iowa
June 9th, 1924.

Red Jacket Mfg Co
Davenport, Iowa.

Attn: H. H. Lafferty.

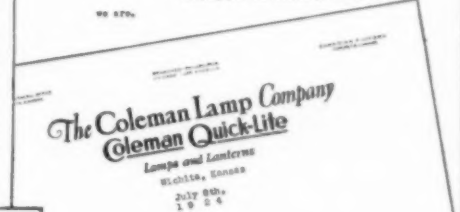
Gentlemen:-

We have used a lot of light castings made we believe that whenever minor castings are made that you will make them.

As to service, we could not ask to be taken care of in better shape, just a few months ago we received by express, and were working castings made from a new carpet pattern, within 48 hours from the time we delivered the pattern to your foundry.

We note you are reaching out for new business and can do no one good feel free to use us for reference.

Yours very truly,
The American Fork & Hoe Co.,
Montrose Works.



July 8th,
1924

Red Jacket Mfg. Company,
Davenport, Iowa.

ATTENTION: Mr. H.H.Lafferty

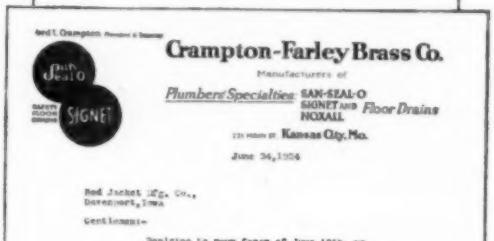
Gentlemen:

Referring to your letter of June 10th, we are more than glad to say that the quality of Grey Iron Castings that you have always furnished us has been highly satisfactory.

During the long period of business relation with your firm, We do not remember of a single time that our requests were not granted, or that there was any indication of service, but a desire to always be at our service. It is none specially the cause of favorable comment and it has been this, for both the quality of in this organization, for both the quality of your materials, and your general method of doing business. We really believe that no firm could have done better.

Yours truly,

THE COLEMAN LAMP COMPANY



June 24,1924

Red Jacket Mfg. Co.,
Davenport,Iowa

Gentlemen:-

Replying to your favor of June 10th, we are pleased to advise that our dealings with your company have with out exception been very pleasant and satisfactory.

The iron is smooth and soft. The castings are true to pattern and your service has been prompt. All of which is very pleasing and profitable to us.

Yours very truly,

F.L.C. Crampton-Farley Brass Co.

Fred L. Crampton

Makes Castings

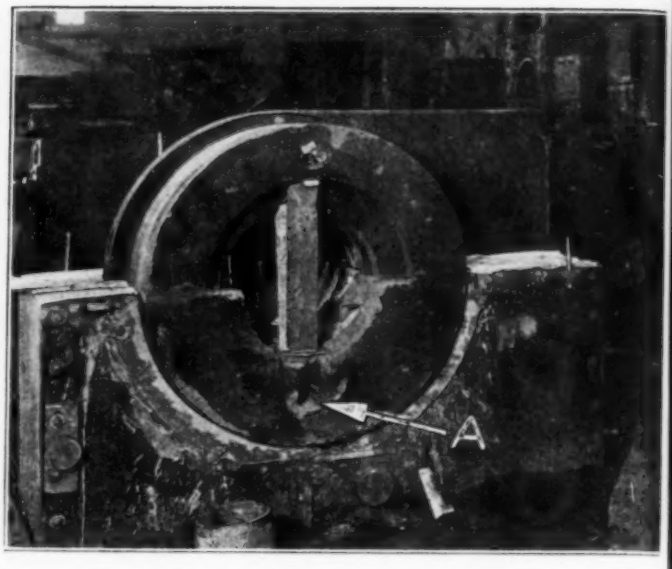


Fig. 2—Hollow dry sand cores for the larger valve bodies are braced

Dry Sand Cores Find Consid
Sand Cores Are Used Ex

WHERE the same general class of castings has been made continuously over a period of many years it is only natural to find that special equipment has been developed and placed in use, also that methods have been standardized to insure a uniform product. The Ludlow Valve Co., Troy, N. Y., established in a small way over 50 years ago for the manufacture of valves and fittings for city water supply systems, gradually has developed into a large manufacturing plant handling the same line of goods. With the exception of steel castings procured from outside sources, all the component parts of valves, hydrants and pipe connections are cast or forged, machined, assembled and tested in one large group of buildings of which the three principal units are an iron foundry, a brass foundry and a machine shop. The iron foundry with which this article primarily is concerned has an approximate capacity of 50 tons a day, and since the rough castings represent only the beginning of the series of operations incident to shipping a finished product, the capacity of the remaining departments may be inferred from that of the foundry.

The plant has direct connection with two main lines of railroad and has ample yard capacity for storage both of raw material and finished product. Coke and iron are stored in the yard immediately in the rear of the cupola and iron flasks are stacked along both sides of a track from which they may be lifted on to a car that conveys them into the foundry. A large number of flasks, particularly those in fairly constant use, are kept at all times inside the building. From the many illustrations it will be noted that iron flasks are employed exclusively even for the smaller castings. They hold their shape better than wood flasks, they fit closer to the pattern and thus reduce the amount of sand to be handled and they last practically indefinitely. Replacement is not a serious factor.

The foundry building of steel and brick construction approximately 150 x 300 feet is divided into three main bays after the manner of nearly all foundries where both heavy and light castings are made under the one roof. The heavy castings are molded and poured in the center bay and the lighter castings are handled in the bays on the two sides. The arrangement is the logical solution of many problems involved in foundry operation where cranes are employed steadily, where materials constantly are in a state of movement and where lighting and ventilating features are more severely taxed than in almost any other type of manufacturing enterprise. Under the arrangement outlined the two rows of steel columns which nominally separate the center from the two side bays, also serve to support the crane runway over the center bay. Also they support a high monitor roof over the center bay provided with a continuous row of windows in the vertical side walls and other windows set only a few feet apart in the sloping part of the roof on both sides. This direct overhead light gives ample illumination in the main bay at all times. The side bays are illuminated by an almost continuous row of windows in the side walls.

This type of construction also solves the ventilation problem, so far as the ventilation problem is capable of solution in a foundry where the temperature in the closing hours of the afternoon differs so widely from the temperature in the early part of the day. The high monitor roof in the center bay attracts the smoke and steam from the molds and cores not only from the center bay but also from the two side bays. On account of the manner in which green sand cores are employed almost exclusively, the acrid and penetrating smoke usually associated with cored castings is almost entirely absent. A quantity of steam is expelled through the vents but rapidly is dissipated and the air in the foundry even at casting time remains remarkably clear.

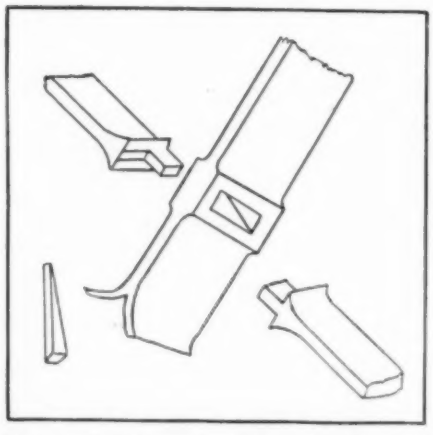


FIG. 1—DETAIL OF ARBOR JOINT ON SMALL VALVE BODY GREEN SAND CORE

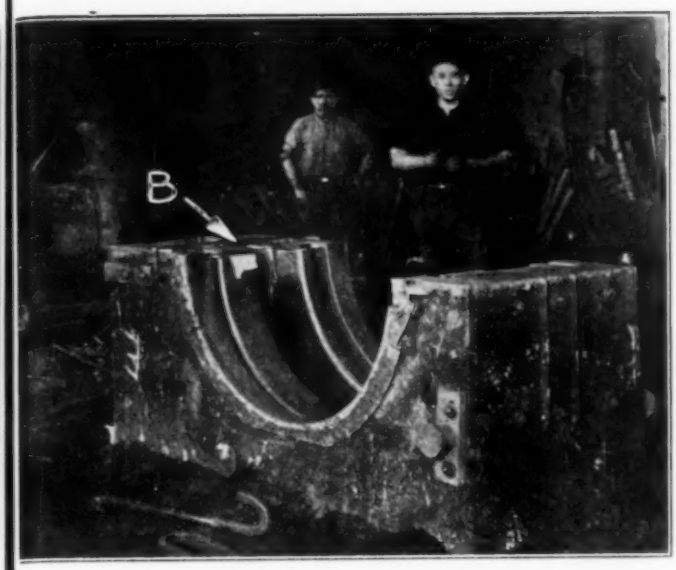
Rapid and convenient movement of material is secured by two traveling cranes in the center bay, one made by the H. Harnischfeger Corp., Milwaukee, and the other by the Morgan Engineering Co., Alliance, O. In addition to the cranes two narrow gage tracks extend from one end of the building to the other, one track in the center of the main bay and the second track in the east bay close to the columns that separate the side from the center bay. A third track is laid in the molding section of the west bay and serves to convey the iron to pour the molds made in that part of the building.

Extensive Cleaning Room

Several short tracks crossing the floor of the building at right angles serve to connect the long parallel tracks so that material may be transferred from one bay to the other. The short tracks also extend into the yard through several doors and facilitate the passage of material into or out of the building. At the north end of the building, the long parallel tracks enter the chipping and cleaning room which extends across the full width of the foundry building. In fact it forms a continuation of the main building and is only separated from it by a brick end wall. Additional tracks are provided in the cleaning room for the convenient transfer of castings from one point to another on their journey toward the machine shop and assembling department.

The large castings are sandblasted in a chamber erected on the foundry side of the dividing wall, but all the remaining

For Waterworks



with wood uprights on the inside to resist the pressure of the molten iron

erable Application, but Green clusively for Hydrants

castings are cleaned in a battery of six tumbling barrels. Four are provided with special long barrels for the reception of the long hydrants and the other two 3 feet diameter, 6 feet long take care of the shorter valve boxes, valve bodies and miscellaneous small parts. The sandblast chamber and the tumbling barrels are connected to a dust arrester system which keeps the air clear in the cleaning room.

Exceptions are noted occasionally, but in the usual routine, castings first are taken to that part of the cleaning room where the tumbling barrels are located and afterward to the larger floor area of the second part of the cleaning room containing the grinding wheels, benches and pneumatic chipping appliances. Narrow gage tracks extend through the doors of the cleaning room and connect with tracks leading to the machine shop.

Melting the Iron

Two cupolas made by the Whiting Corp., Harvey, Ill., are provided for melting the iron. One is 65 inches inside diameter and is employed almost continuously. The second cupola lined to 44 inches is held in reserve as a spare and also is employed during periods of depression or on odd days when for any reason the volume of work on the floor does not warrant the use of the larger cupola. The charge for the large cupola is made up of coke and iron in the proportion of 6000 pounds of iron to 600 pounds of coke with 2400 pounds of coke on the bed. The cupolas are housed in the center of the west bay with the spouts projecting through a brick wall into the main bay where the iron is delivered into the large crane ladles the center bay or the buggy ladles which convey the iron to the two side bays. The blast is furnished by a fan made by the B. F. Sturtevant Co., Hyde Park, Mass.

The remaining space in the west bay is taken up by floors on which small castings are made as typified in the illustration Fig. 6, and by part of coremaking department. The smaller cores are made on benches and baked in several coke fired ovens. The larger cores are made on the floor, dried in ovens at the end of the center bay and assembled at a point where they may be handled and transported by one of the traveling cranes. Large cores only are made in comparatively small numbers and usually are placed in the waiting molds immediately after they are made as in ordinary jobbing shop practice. Small cores both plain and special are made in large quantities and stored in racks in a part of the coreroom set apart for the purpose. The molders draw their daily supply from these racks and the daily core production is gaged to correspond with the mold demand so that at no time does the reserve core supply exceed a few days' requirements.

Detail of the mold and core for a 42-inch flume valve body are shown in Fig. 2. The flask construction is simplified to a point where the frame for each half consists of four open-sand plates bolted together at the corners. Two trunnions are bolted on each side, one near the center and the other near the end to facilitate rolling the flask easily, steadily and quickly. It may be noted that the flask is wider than it is long and therefore when the time comes it is rolled end over instead of side to side as in ordinary practice. The flask is a tight fit for the pattern in the foundry sense that only a minimum amount of sand is packed between the pattern and the walls of the flask. A semicircular opening is provided in each side and forms a continuation of the core print designed for the reception and support of the core. Accuracy is imparted to the opening by a light cast iron half ring bolted to the side of the flask at each opening. This half ring embraces the pattern core print closely while the mold is being rammed and also serves for a solid support for the circular end of the core when it is lowered into place. The sand print is shaved to provide a reasonable clearance and obviate any danger of the green sand crushing under the weight of the core.

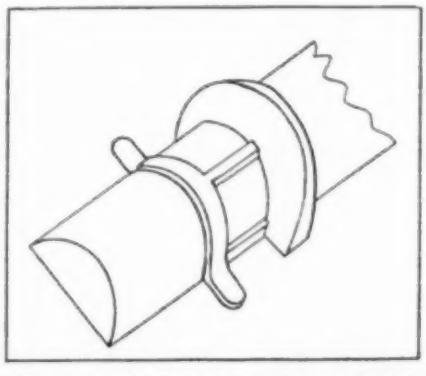


FIG. 3—A SET GATE WITH THREE BRANCHES IS ATTACHED TO THE CORE PRINT

The core is made in two halves which are pasted together after they are dried. Pieces of scrap rod or pipes are used to reinforce the core and the inside is made hollow for the double purpose of conserving the sand and facilitating the drying of the core in the oven. A layer of coke is incorporated in each half for the same purpose. A section of 3-inch pipe with one end showing at *A*, Fig. 2 is rammed in the bottom half of the core and serves as a convenient receptacle for the long bar to which the crane slings are attached in handling the assembled core. The two slings are suspended from a beam in such a manner that the core is balanced in one direction while a chain and turnbuckle attached to the end of the straight part of the core are employed to level in another direction.

Short pieces of 2 x 4-inch scantling are wedged upright in the opening in the core so that when the mold is closed the core may be wedged firmly in place. The *lift* or upward pressure on the core is between 7 and 8 tons and the core is dependent altogether on the extremities of the three prints to hold it in place during the pouring operation.

After the two hanging bodies of sand in the cope have been secured by two small pieces of board held in place by a clamp as shown at *B*, Fig. 2, the cope is rolled over and closed down on the drag. It is tried off at least once to see that no sand has been dislodged at any point. After the final closing, the joints between the ends of the cores and the iron rings at each end of the flask are

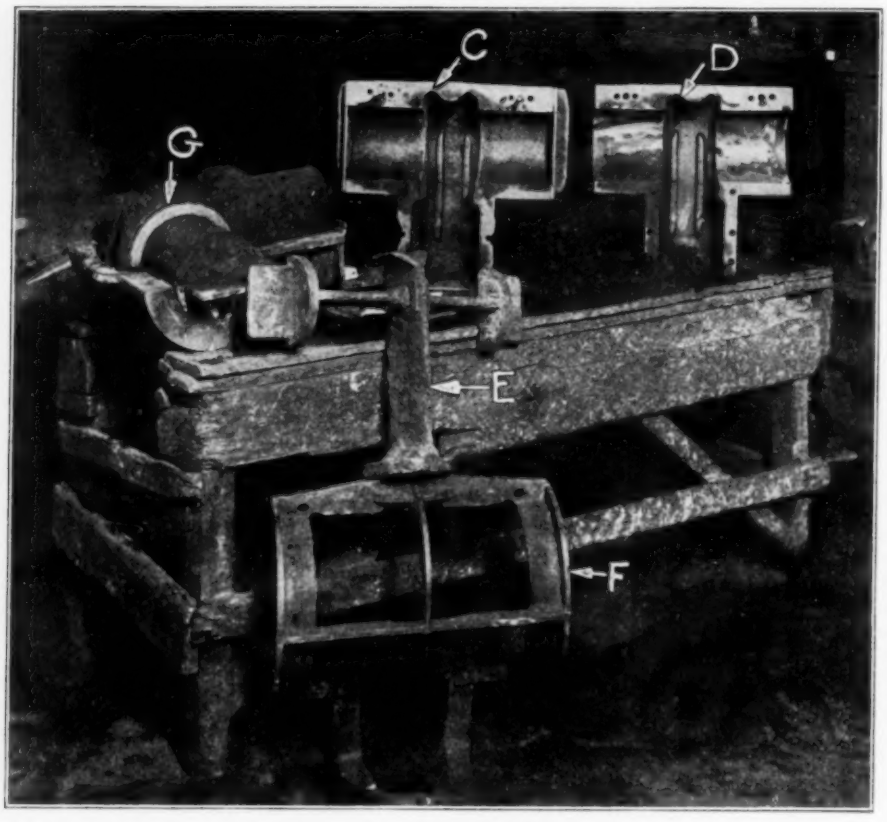


FIG. 4—GREEN SAND CORES FOR SMALL VALVE BODIES ARE MADE IN A METAL COREBOX SPLIT THROUGH THE CENTER A CAST-IRON ARBOR MADE UP OF THREE PIECES LOCKED IN THE CENTER IS PLACED IN THE DRAG HALF OF THE CORE

daubed with clay. An auxiliary ring is clamped at each end over the daubing to prevent a runout at any point.

Smaller valves of the same general type are made entirely in green sand as shown in Figs. 4 and 7. The molds are jolted on a machine made by the Tabor Mfg. Co., Philadelphia and the cores are rammed by hand in a two-part metal corebox. The molds present no special points of interest outside the manner in which the flasks are handled. Instead of the usual handles, each flask is provided with a short hollow trunnion on each of two opposite sides. The device employed for lifting the flasks is made from a 1-inch steel bar bent in the manner shown in the illustration Fig. 7. A short toe at either extremity engages the cavity in the trunnion. When in use the toes engage the trunnions closely and prevent the flask from slipping accidentally at any stage of its progress. The ring construction of the lifting device at the point where it engages the crane hook, provides sufficient flexibility so that the workman easily may snap the toes into and out of the trunnions. Each of the side floors on which these valve bodies are molded is provided with a light crane equipped with a chain block. A group of machines engaged in the production of a similar line of castings on the main bay floor is served by three hand operated jib cranes. The molding machine equipment in the foundry was supplied by various interests including the Arcade Mfg. Co., Freeport, Ill., Tabor Mfg. Co., Philadelphia and Henry E. Pridmore, Chicago. In addition the Ludlow Co. built many of its own machines.

The bench and the necessary equipment for making a 6-inch gate valve body core in green sand are shown in Fig. 4. It will be noted that *C* and *D* constitute respectively the drag and cope half of the corebox, *E* is the arbor, *F* is the carrier employed in transporting the core to the molding floor. It is a skeleton and only touches the core at the bearings where the arbor projects. It is shown in place on the extreme left end of the bench.

The two halves of the corebox are filled with sand independently of each other. The cope half contains nothing but sand, but an arbor is placed in the drag half to support the core in place in the mold. The arbor consists of three plain members. The center or upright member as is shown at *E* is pierced by a rectangular opening near one end and the inner ends of the two side members are locked with a wedge in this opening. From the illustration it will be noted that the ends are provided with shoulders that automatically locate them in the proper position and render them rigid when wedged in place. Detail of the joint is shown in Fig. 1.

The corebox *C* for the cope half of the core is provided with an end piece at each of the three extremities. The half round end piece on each end of the arbor serves to retain the sand in the drag half *D* of the corebox. The facing strips, one of which *G* is shown in Fig. 4 are adjusted in place in each half of the box before the sand is shoveled into the box. After the box is removed the strips remain in the sand and are removed separately immediately afterward.

Core Carriers

The two halves of the corebox are filled with sand and rammed independently while in a horizontal position side by side. They then are turned up vertically, face to face, joined together and lowered back horizontally on the bench with the *drag* side, *D*, of the core on the upper side. This half of the box

FIG. 5—GREEN SAND CORES FOR SLEEVES ARE MADE IN HINGED COREBOXES WITH A CAST IRON ARBOR IN THE DRAG HALF OF THE CORE

is removed and replaced by the carrier, *F* The carrier closely embraces the three projecting ends of the arbor and while it follows the contour of the core it does not touch it at any other point. The carrier, together with cope half of the corebox, *C*, and the entire core are rolled over as a unit thus bringing the core into its correct relative position with the arbor in the lower half. The carrier serves as a guard and prevents damage to the core while it is in transit between the core bench and the molding floor. Arrived at its destination, the molder grasps the projecting ends on the arbor and lifts the core out of the carrier and places it in the mold. The same projecting ends of the arbor serve as anchors in holding the core in its place while the mold is filling with iron. The ends are wedged down from the cope.

The manner in which cores and molds for short sleeves are made is illustrated in Figs. 5 and 6 respectively. The molds are made on a plain stripping plate machine and are rammed by hand. On account of the shape of the pattern and the generous draft allowance on the shoulders, it is only necessary to drop the pattern about ¾-inch to clear before the half mold is removed from the plate.

Flask Construction

The facility with which repetition work lends itself to improvement in flask design is illustrated in Fig. 6. The flasks shown measure 15 x 48 inches with cope and drag each 7 inches deep. No bottom board is required and the sand is held in each half of the flask by two bars spaced 16 inches apart. Each flask is cut out at the end for the reception of the core. The manner in which the flasks are lifted is illustrated in the cope resting on a stand near the back of the floor in Fig. 6. A short steel bar is inserted in each of the four lugs provided for the purpose and after the flask has been placed in position, on the floor if it is a drag, or on top of the drag if it is a cope, the bars are removed.

The advantage of this method over the former type of flask in which the handles were cast integral with the frame is obvious. A few old type flasks still are in use, for example the second and third drag from the front in the row of molds to the right in Fig. 6. A flask suspended from long handles is lifted and transported more easily than one provided with little short stumpy handles. The objection to the long handles is that they interfere with a free passage in the gangway. However, with the detachable type shown this objection automatically is removed.

The core is held down in the mold by a short prop wedged upright between the projecting end of the arbor and a rectangular lug cast on the end of the flask for the purpose. This feature is shown at *H*, Fig. 6. The molds are poured through two small, single pop gates located on a center line on the highest part of the mold and at a convenient distance from each other. With this type of gate a narrower flask may be employed than where the usual style gate with many branches is cut in the joint at either side of the mold. The flasks are made in the foundry from a plain rectangular pattern provided with two transverse bars and a semicircular gap on the joint side of either end. The various lugs are formed by suitable cores rammed up with the pattern. The flask walls have an average thickness of ½ inch and with ordinary care last indefinitely. When one occasionally is broken it is replaced easily.

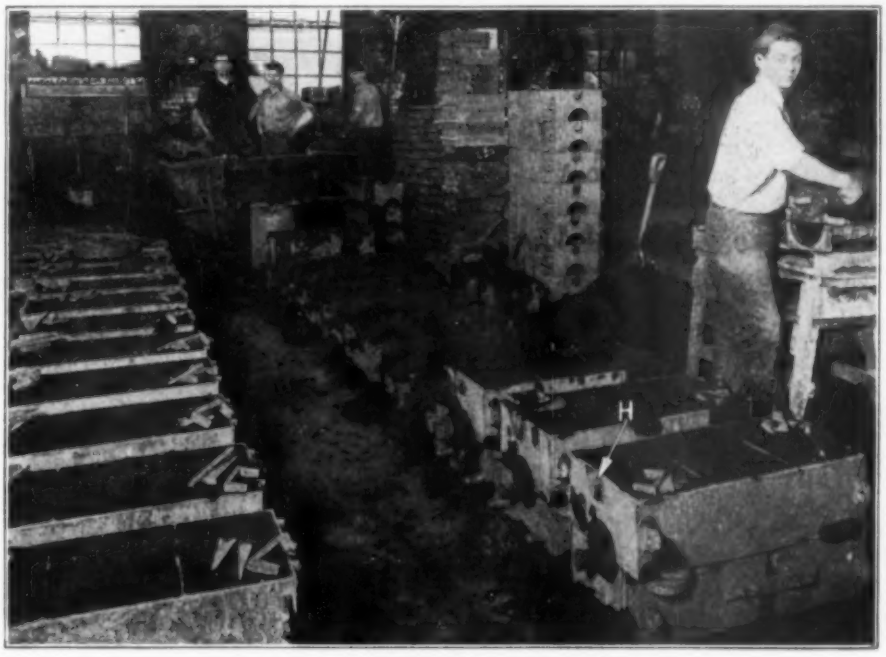


FIG. 6—MOLDS ARE MADE ON A STRIPPING PLATE MACHINE IN TIGHT FITTING FLASKS AND POURED THROUGH TWO SMALL POP GATES

Hinged metal coreboxes similar to those shown in Fig. 5 are employed in making the green sand cores for sleeves of various kinds. The two halves of the box are machined accurately and fitted with hinges which also serve as guides in locating one half core in its proper position on the other half. In practice the box is opened out on a pair of horses. The cope half is filled heaping full of sand which then is pressed down firmly by hand and scraped off flush. A channel is cut along the center of the joint from one end to the other to furnish a vent channel for the gas. Sand to a depth of 1 inch is placed in the drag half of the corebox and the clay-washed arbor is rubbed down to a bearing on both ends. The remainder of the box then is rammed full of sand and after the surplus sand is scraped off the two half boxes are swung up vertically until the two sand faces coincide. The entire box then is lowered back on the bench with the half containing the arbor underneath. The cope half is rapped and rolled back into position for another core. The coremaker and his helper, one at each end, grasp the projecting end of the core arbor and lift the completed core out of the box. The core usually is placed directly in the waiting mold.

A rich mixture of new and old sand is used for these green sand cores, and a considerable degree of skill and experience is required to ram the sand to the proper density. If it is rammed too hard the casting will blow and if the sand is not rammed sufficiently hard it probably will drop from the lower side of the arbor. If it does not drop it will yield to the pressure of the molten iron and as a result the casting will present an uneven surface on the inside. The casting also will be over weight.

Methods and equipment employed for making the molds and cores for hydrants are shown in Figs. 8, 9 and 10. Floors for the shorter hydrants are laid off in the usual manner at right angles to the side wall of the building, with the molding machine at the extreme back end of the floor. Each floor is spanned by a 2-ton electric crane supplied by the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y. The hoists are controlled from the floor.

Long hydrants are molded on several floors similar to that shown in Fig. 9 and laid off parallel to the side wall of

FIG. 7—SMALL VALVE BODY MOLDS ARE MADE ON A JOLT RAM STRIPPING PLATE MACHINE THE CASTING IS SYMMETRICAL AND ONE-HALF PATTERN SERVES FOR BOTH COPE AND DRAG HALVES OF THE MOLD

the building. The molds are rammed on that part of the floor nearest to the wall while the molds are assembled and poured on the floor adjoining the narrow gage track on which the iron is conveyed from the cupola. Later, the castings are conveyed on the same track to the cleaning room.

All the molds are made on stripping plate machines. The smaller molds are jolted, but the larger flasks are rammed by hand. Close fitting, cast iron flasks, with an opening at each end and with the bars cast integral with the frame, are employed on the hydrant floors. Both cope and drag are barred, a feature that obviates the use of bottom boards. Both halves are the same depth and the only difference in their construction is that at one end the drag is provided with a rectangular opening instead of the semicircular opening showing at the opposite end and in both ends of the cope. The rectangular drag print feature is illustrated in several completed molds shown in Fig. 10. The long cores are circular in cross section for the greater part of their length, but are more or less irregular in contour at one end where various lugs and branches are attached for hose connections. The rectangular print on the drag side of this end of the core insures that the core will be lowered accurately into its proper relative position in the mold.

One of the long hydrant patterns as it appears on the ramming table without the loose hose connections is shown in Fig. 9. Approximately one half the pattern is made up of 6-inch sections. The end flange also is detachable and with this arrangement the pattern may be adapted to making hydrants of various lengths.

The casting is poured from one end through several shallow branches located on the core print. The edge of the print does not fit closely around the core and as a result the fin encircling the core serves as an auxiliary gate. An upright gate pin is rammed in the cope on each side of the core print. The lower end rests on the projecting end of the set gate and the upper end terminates in a pouring basin. The gate pins are pulled out before the cope is lifted and no attempt is made to slick a foundation for the pouring basin. Before the cope is placed on the drag the gate pins are returned and the surface of the sand in their vicinity is slicked smooth to form a bottom for the pouring basin. To prevent the iron from coming into contact with the flask bars, a light wood frame 10 inches wide inside, about 15 inches long and 1 inch deep is placed around the gate pins. It is filled with sand which is pressed down firmly and then scraped off flush and slicked. The runner box is placed on this prepared surface, the gate openings are covered with a suitable block and the space between the sides of the box and the block are rammed full of sand. The block then is removed, leaving a clean, smooth, firm basin into which to pour the iron.

Arbors shown in the foreground Fig. 8 are employed to support the green sand forming the cores for the long hydrants. The lower part of each is equipped with semicircular ribs spaced on 6-inch centers. The upper part of the arbor is similar to the lower part with the exception that it carries no ribs and serves simply as a reinforcing member to prevent the core from bending in the mold. No chaplets are employed in hydrant castings to hold the cores in place.

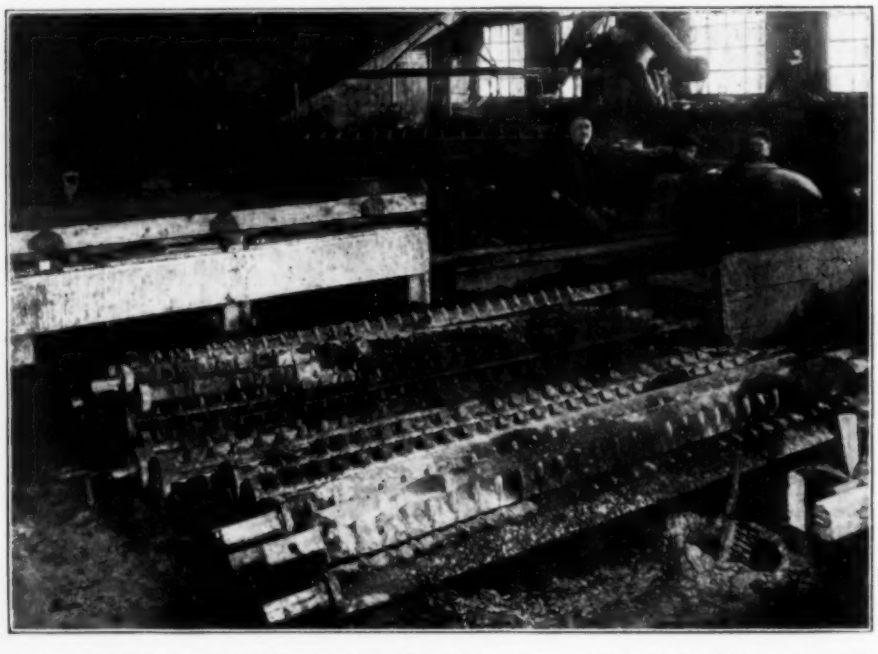


FIG. 8—RIGID CAST IRON ARBORS SUPPORT THE GREEN SAND CORES IN THE LONG HYDRANT MOLDS AND DISPENSE WITH THE USE OF CHAPLETS

Long Green Sand Cores

One of the coreboxes for making the long hydrant green sand cores is shown mounted on a bench in Fig. 8. Each core is lifted out of the box after it is made and the box remains permanently on the bench until the order is finished. The box is shaped from a solid piece of wood with several battens screwed on the bottom to maintain its shape and prevent it from splitting. A shoulder extending from end to end at each side on the upper surface guides a semicircular strike employed in forming the upper half of the core. The greater part of the core is plain and may be formed

in this manner, but that part of the core shown to the right in the illustration and destined to form the hose connection end of the casting, is formed inside a cast iron shell split in halves. The lower half of the shell is attached to the inside of the wood corebox and the upper half is located in place on the lower half by suitable dowel pins.

The cores are made from a mixture of approximately half and half new and old sand. The arbor is claywashed and placed in the corebox and a sufficient quantity of sand is shoveled on top of the arbor to enable the coremaker to ram it flush with the tops of the wings. At this point the upper half of the iron shell is placed in position over one end of the box and the ¾-inch vent rods are laid in the angle formed by the wings and the backbone of the arbor. Instead of one long rod extending from one end of the core to the other end, two rods are placed on each side of the backbone. The rods meet in the center and project through the open end of the corebox so that they easily may be withdrawn before the finished core is lifted out of the corebox.

Sand in the lower half of the core is packed with short rammers under and between the side wings on the arbor. The sand forming the upper part of the core is pressed into place with the hands and the surplus amount is scraped off by a semicircular *strike*. The inside of the strike conforms to the shape and dimension of the required core and the strike is guided along the box by a raised shoulder on each side. Lugs on the inside of the iron shell are held in place by long pins until the sand has been packed around them. Then the pins are withdrawn, the upper half of the shell is removed, the loose pieces are extracted one at a time, after which the completed core is lifted out of the corebox by two men and placed in the mold.

FIG. 10—THE SHORTER HYDRANT MOLDS ARE PUT UP ON LONG FLOORS THAT EXTEND FROM THE GANGWAY TO ONE OF THE SIDE WALLS OF THE FOUNDRY

Describes Plant

G. V. Brook, chief chemist of the British Aluminum Co., Ltd., in a recent lecture delivered before the Birmingham Metallurgical society, England, described in detail the electric plant at Kinlochleven, Scotland, where the water power of the adjacent hills is utilized for the production of 33,000 horsepower absorbed by the plant for the production of aluminum. An important requisite was the discovery of a market for the use of red oxide of iron produced in the course of aluminum manufacture. Its principal use at present was for making paint. Mr. Brook believed that a large fortune could be made if any one could put it to further use, the present production being far in excess of any visible demand.

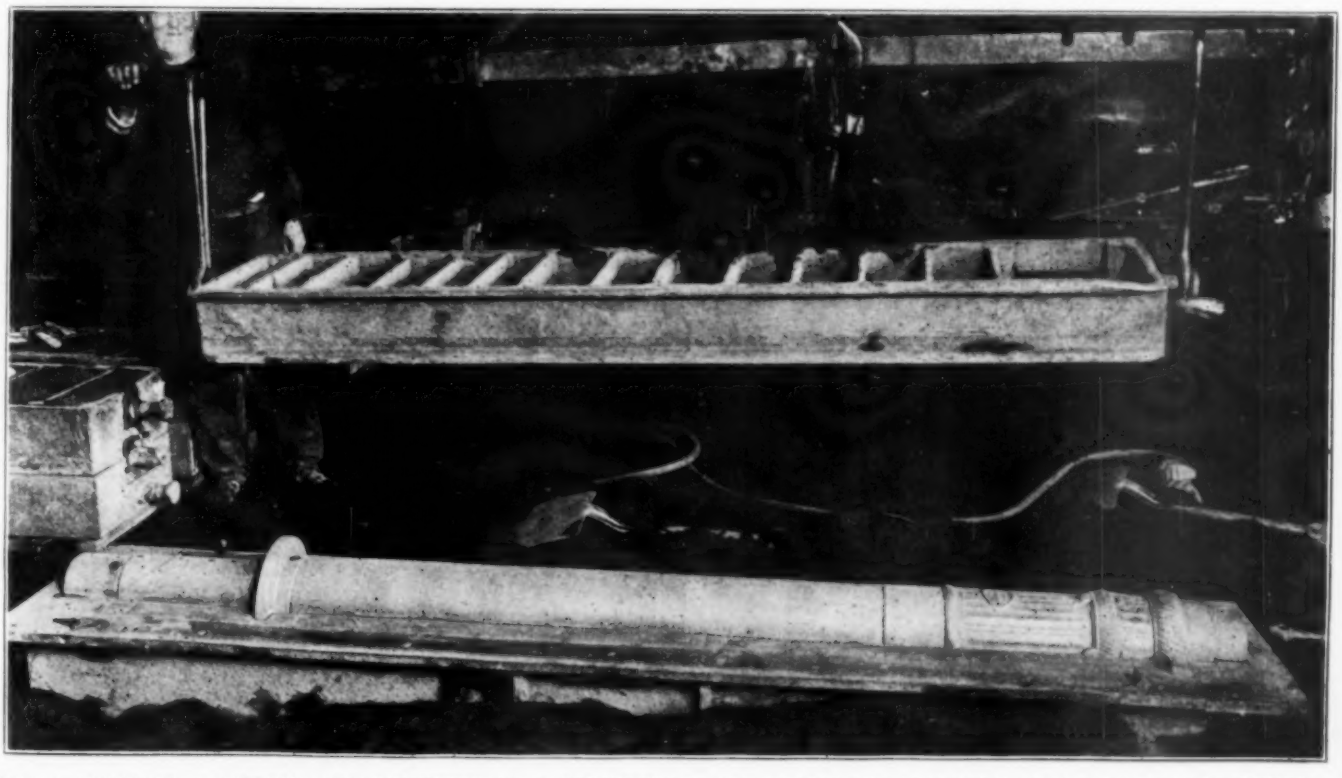


FIG. 9—HYDRANT PATTERNS ARE MOUNTED IN A STRIPPING PLATE FRAME SET SLIGHTLY ABOVE THE FLOOR LEVEL—THE SAND IS RAMMED BY HAND

Making Hard Manganese Steel

Involves Careful Treatment

Wear of Manganese Steel Depends on Proper Heat Treatment—Imperfect Handling in Heating and Quenching Causes Castings To Remain Brittle—Individual Attention Necessary in Most Cases

By Hubert Hermanns and Hermann Meixner

CRUSHING stamps and shoes 3 inches and over in diameter have been made of hard manganese steel in numerous cases, but usually without success. Components of this kind are better cast or forged chrome or other steels of special analyses. Particularly difficult is the production of large balls for ball mills which in the subsequent heat treatment frequently developed tension cracks not visible from outside but capable of bursting the balls during operation. These detrimental phenomena can be minimized by placing the balls upside down soon after pouring in order to reduce pipe. In producing plates for breakers any shrinkage of the plates can be prevented by providing a sufficient number of risers and bridges or crosses in the mold.

The surface of fracture always shows a fine grain in the case of small cross sectional areas. In the case of large cross sectional areas the structure should show a radiolated surface because the greater adhesive force of these crystals compared with those of the finer grains will impart a superior toughness to the material. For this reason the material shows more permanency as regards wear by friction. Wheels made of hard manganese steel should not have straight but curved arms. Care should be taken that they have no box shape sections. Openings at least should be provided in the walls of such castings. Ribs of any considerable size used on castings should also have openings to insure satisfactory results during the subsequent heat treatment.

This is the concluding installment of an article dealing with hard manganese steel; the first was presented in the April 15 issue, page 323.

Shrinkage Rate Is High

An important point is to give the castings such shape as to facilitate shrinkage. The latter is comparatively large, amounting to 2.75 per cent on the average. To obtain satisfactory shrinkage sharp corners must be avoided, and any corners must be well rounded off. As hard manganese steel cannot be machined except by grinding, any holes required must be cast to exact size. The tensile strength of hard manganese steel averages from 113,700 to 142,000 pounds per square inch and the elongation from 12 to 20 per cent. Owing to its toughness the hard manganese steel may be bent in the cold state after the heat treatment. Fig. 6 shows two rolls with fine grooves as used for grinding. The rolls are fitted with a four-part wrought iron insert which is cast in and later is machined. The bent specimen was given 13 blows with a ram weighing about one ton and falling from a height of about 20 feet. The piece showed a deflection of 13 inches without any cracks developing in the roll. The carbon contents of the casting amounted to 1.29 per cent and the manganese content to 12.5 per cent.

Hard manganese steel should not be subjected to blows because it is expanded slightly by the influence of the impacts and thus shows a property which is little desirable. In the case of ball mills, except those that are stressed to the utmost, the components can be cast from chrome steel to advantage since this grade shows exceptional resistivity against wear. On the other hand, it is advisable in any case to use hard manganese steel for the production of ordinary armor to avoid the difficulties heretofore mentioned.

A comparison between chilled castings and hard manganese steel in connection with the behavior to wear during operation, is interesting. While chilled castings possess a hard skin only, hard manganese steel shows the same degree of hardness all over the cross sectional area. Hence the former will show irregular wear and a low degree of usefulness only. This will amount to 25 per cent of the total volume of material with a wall thickness of 4 inches which is required owing to the low tensile strength. When using hard manganese steel, however, the wall thickness may be decreased to about 2 inches. Approximately 75 per cent of this wall thickness is utilized while 25 per cent must be counted as lost. This loss may be decreased, if the back of the casting is

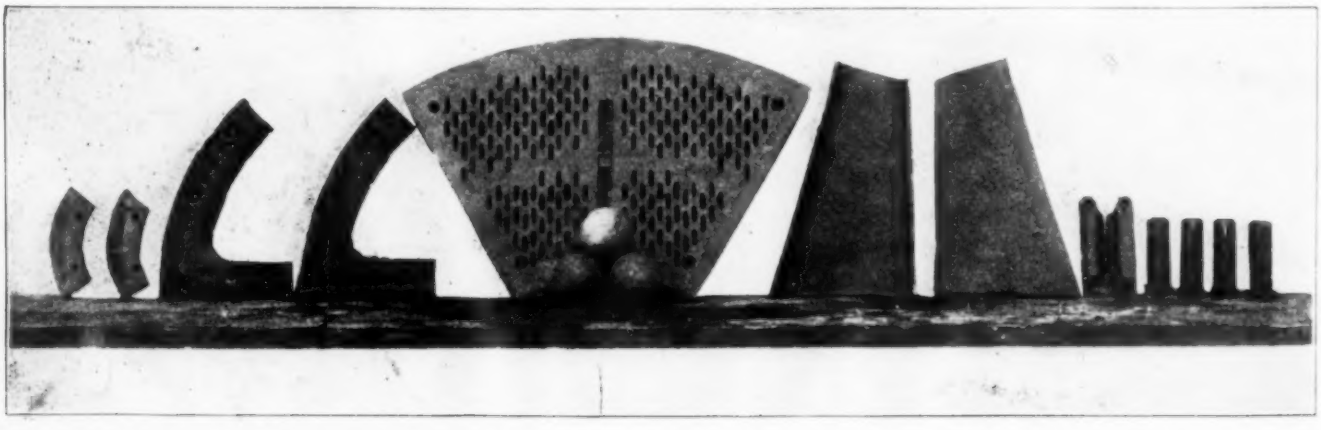


FIG. 2—CASTINGS MADE FROM HARD MANGANESE STEEL. FROM LEFT TO RIGHT ARE REPRESENTED PLOUGH SHARE HOLDERS, CLAY CUTTER SECTORS, COMPONENTS FOR BALL MILLS, CHAIN LINKS AND DREDGER BOLTS

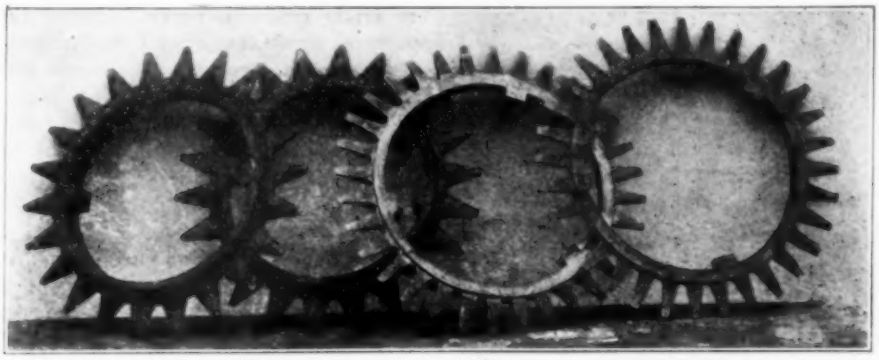


FIG. 3—TWO DIFFERENT SIZES OF RINGS USED FOR ROLL BREAKERS

stiffened by ribs as shown in Fig. 5.

Chilled castings, therefore, involve considerable losses of material which in the case of hard manganese steel are much smaller. In contrast to the chilled casting which is hard but not tough, those of manganese steel show hardness combined with toughness and a maximum of durability. Owing to this hardness any breakages are impossible in the case of hard manganese steel, provided the material has been treated and worked properly. In this manner failures are prevented and the maintenance charges of the machine are reduced to a minimum. In spite of the higher price hard manganese steel is cheaper in the long run when used for disintegrating and grinding machines than chilled castings of forged steel.

Tests Are Conducted

Comparative tests with cast frogs recently have been carried out by the Paris underground railway on hard manganese and ordinary steel. In the case of hard manganese steel vertical wear amounting to 0.04-inch did not show before 193,333 trains had passed; in the case of ordinary steel 24,300 trains produced the same result. On account of its special properties hard manganese steel is particularly suitable for shackles and chain links. The products can be made lighter in weight than when cast steel is used. In addition they have greater resistivity against abrasion by dust and sand and therefore much longer life. Bolts of hard manganese steel for elevators, chains and dredgers should be fitted with bushes of hard manganese steel. Sprockets of hard manganese steel are lighter than those of cast steel and are provided with bushes of soft steel which may be drilled and machined. Grates for edge mills also are made of hard manganese steel to advantage and have given satisfaction.

Fig. 3 represents hard manganese steel rings for roll breakers of two different sizes. During pouring special attention has to be paid to the cams because at these points a larger wall thickness will result. Jaws for breakers are represented in Fig. 5. The way in which the ribs have been designed is worth attention. From Fig. 4 the working surface of the breaker jaws can be seen. The production of large rings of hard manganese steel as in Fig. 7 will be more difficult. Special care has to be taken to obtain even cooling of the rings in the mold. In the case of grinder rolls accurate finish of the holes and grooves is of special importance. In Fig. 2 are represented, from left to right: Plough share holders, clay cutter sectors, components for ball mills and balls, chain links and dredger bolts.

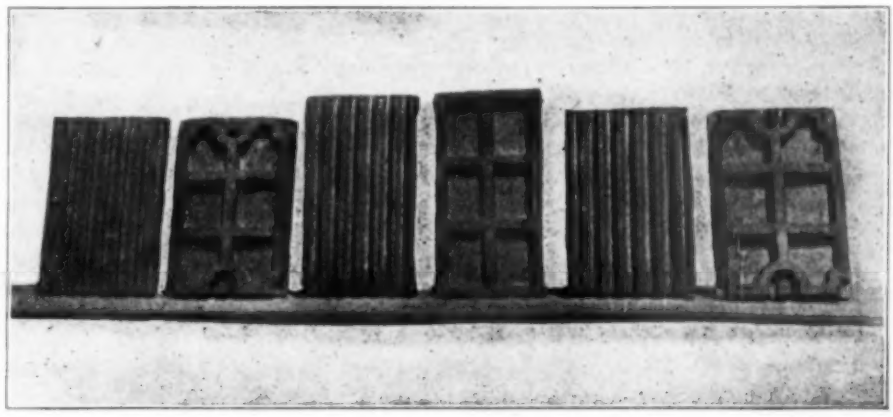


FIG. 5—VARIOUS TYPES OF BREAKER JAWS SHOWING SIX DIFFERENT DESIGNS OF RIBS

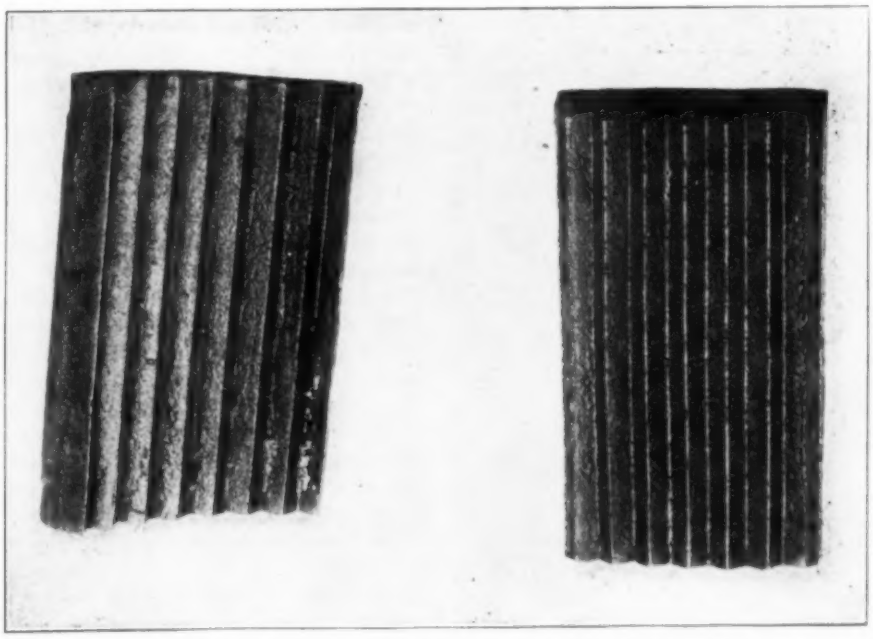


FIG. 4—JAWS FOR ROLL BREAKERS SHOWING THE WORKING SURFACE

Hard manganese steel in the raw state is brittle and is made tough by treatment in water. The resistance to wear through friction will depend on this water treatment, untreated material showing much lower wearing qualities than treated material. The carbon content and the grain, whether radiolated or granular, are not important from the standpoint of wearing quality; they depend largely on the heat treatment. The untreated hard manganese steel is sensitive to blows. Castings with greater wall thickness or irregular cross sections that are moved from the molds a little too early will develop

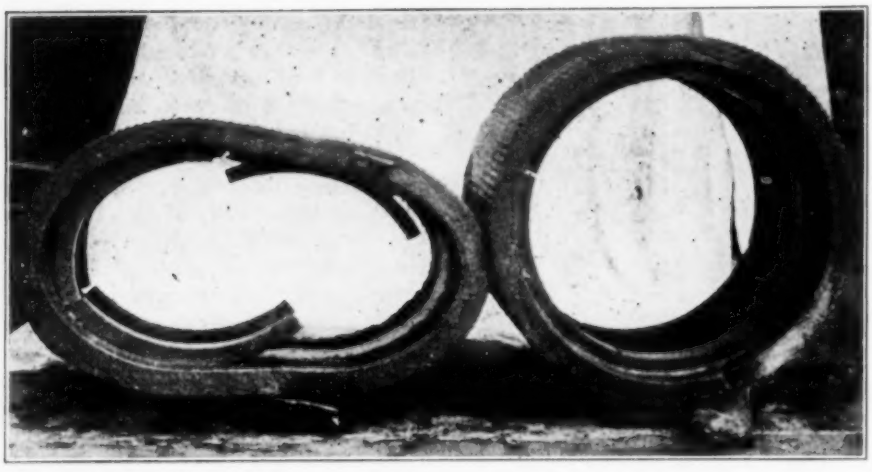


FIG. 6—HARD MANGANESE RINGS EQUIPPED WITH FINE TEETH FOR GRINDING PURPOSES. THE RING AT THE LEFT WAS BENT COLD AND SHOWED A DEFLECTION OF 13 INCHES WITHOUT CRACKING

tension cracks simply by the action of the air. During the subsequent water treatment the cracks may become larger rendering the casting unfit for use. These fine hair cracks frequently develop when the outer surfaces of the casting still are covered with hot molding and, while air is admitted freely to the interior surfaces. Hence, it is best to let every casting cool down in the sand and knock off the gates by one well directed blow. Frequently hair cracks develop in balls of larger dimensions. These cracks enlarge toward the outside during the treatment and may cause breakage of the balls.

Water Used For Quenching

Castings to be heat treated first are preheated to a certain temperature and then quickly quenched in cold water. While in the furnace the castings must be heated uniformly to the same temperature. Plain castings of small weight and with a carbon content of 1.2 to 1.25 per cent may be placed in the cold state into a furnace of 400 to 500 degrees Cent. As soon as the castings have been heated to the temperature of the furnace the latter is raised rapidly to 950 to 1000 degrees Cent. Castings of small cross section should remain in the furnace for about 15 minutes at this temperature until they become heated uniformly in all parts and throughout their cross sectional area. As soon as this condition has been attained the castings are plunged quickly into a tank of water.

Heavy castings should be removed from the molds soon after solidification is completed. After removing the gates they are cleaned rapidly. The temperature of the furnace, into which the castings are placed, should show about the same temperature as the castings themselves to prevent tensions being set up.

As a protection against the formation of oxides either muffle or annealing furnaces of usual design with fire bridge in front may be employed. The muffle fired longitudinally should not exceed 30 feet in length. Annealing furnaces fired from the side respond quickly as the hot gases have to negotiate comparatively short distances only. Further, the metal being in closer proximity of the fire, is heated more rapidly and the temperature is more uniform. The openings for the waste gases are narrowest immediately in front of the fire gradually becoming wider toward both sides to distribute the heat uniformly. Every hard manganese steel casting shows a layer of oxide which becomes thicker, the longer the castings remain in the furnace. Immediately below the layer of oxide is a second layer which also has little resistive powers. Only below the latter is the really hard layer showing a depth of 0.47 to 0.70-inch. The depth of this layer will determine the maximum wall thickness admissible which, as previously mentioned, should as a rule not exceed 2 inches. After this hard layer has worn away the casting can be treated again with the same result.

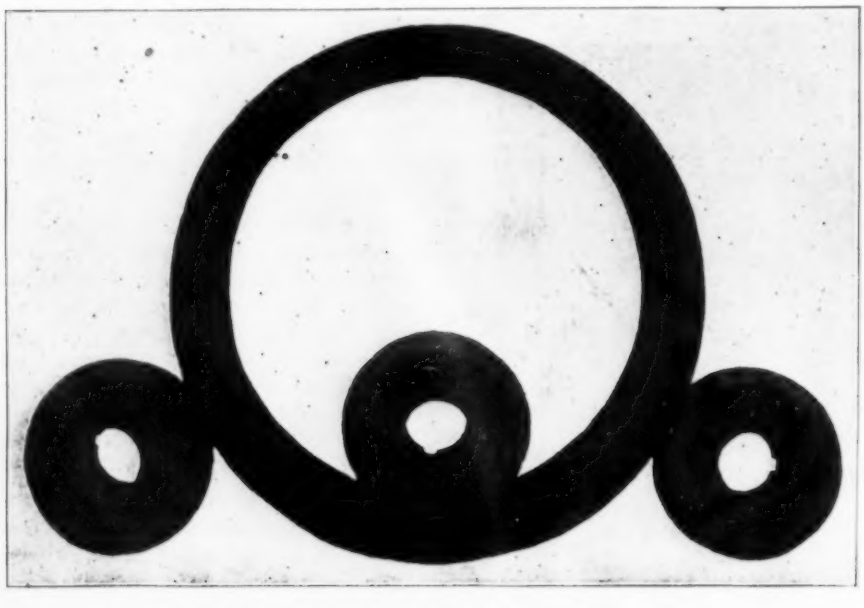
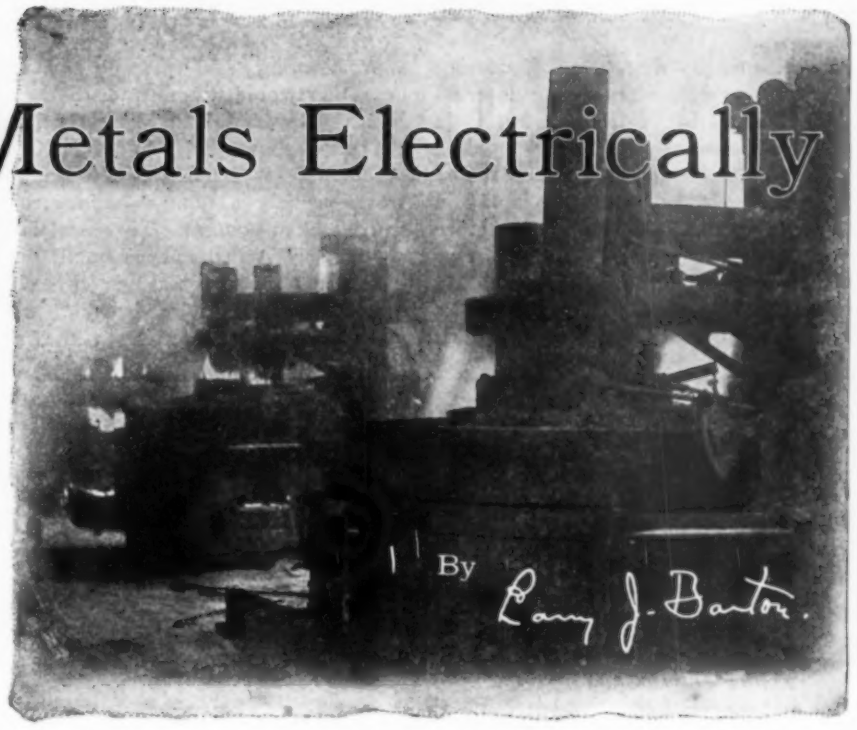


FIG. 7—LARGE RINGS MADE OF MANGANESE STEEL

Temperature Is Constant

The bath used for quenching must be kept at an even temperature by a copious supply of water. The size of the water tank should be such as to allow the castings to be moved up and down as well as sidewise during cooling. Cooling itself should be speeded up as much as possible. Any localized heating of the water must be prevented. The castings should be free from sand more especially in the core holes so that the metal may come into immediate contact with the water at all points. The castings must not rest on the bottom of the tank because the water is impeded in reaching all parts. A slotted receiver plate or a riddle closely fitting the tank should be used for removing all the castings simultaneously without the necessity of draining off the water. This arrangement will effect a considerable saving in water. Any danger of heating the water, however, must be entirely eliminated. In the case of cylinder shape castings a basket can be used to advantage both for lifting the castings from and moving them about in the bath. Before plunging a casting into the water tank the layer of oxide is removed using a scraper. In any case the whole heat treatment has to be carried through most carefully and individually with every casting. None but small and thin walled castings may be treated at one time in smaller groups. With imperfect treatment the castings remain brittle and do not show the wearing qualities required. If all rules are strictly followed, the percentage of waste in the production of hard manganese steel will be low.

Refining Metals Electrically



Chapter V (Concluded)

Limited Manganese in Steel Gives High Physical Properties

MANGANESE steels for special service are of varying carbon content, with the manganese percentage running from 1.25 to 1.75 per cent. These classes of castings have been known for many years, and offer such excellent properties that they may be classed among the true alloy mixtures. This metal offers great strength with a maximum of ductility, desides being naturally solid. Under most treatments, it offers free cutting qualities, giving a beautiful appearance when machined, and being capable of taking a high polish. Therefore it finds great use for any class of casting requiring a metal of high test, which must have considerable machining performed on it before ready to use. For castings to resist high pressures it cannot be excelled, seldom requiring bushing to hold liquids under heavy pressures.

These special manganese steels should be differentiated from the high manganese metal which has been described in Chapter IV. The high manganese steels range from 7.00 to 14.00 per cent in manganese content. The use of the previously described material is confined to service where extreme hardness is essential, such as in railway crossings and frogs, crushing or grinding machinery and in heavy duty pumps, gears and other parts. It is not machinable, but may be ground to finish surface. The high manganese steel ranges from 90,000 to over 100,000 pounds tensiles strength, with an elastic limit of about half those amounts and elongation of about 20 per cent.

The special manganese steel at present under consideration has a much lower percentage of manganese. Its manufacture offers no difficulties and it may be made either in the acid or basic furnace. Good scrap should be used as a base, and the manganese added sufficiently ahead of the pour to assure perfect diffusion.

This percentage of manganese makes this steel sensitive to treatment, and considerable care must be exercised in this respect. While it does not appear possible that such a metal could contain oxides, such is the case, and the furnace practice must be of the highest if good results are to be obtained. The oxide manifests itself in cracks or tears, generally appearing during or after heat treatment. Another prolific cause of rejections are non-metallic in-

TABLE XLIX

Comparative Tests of Manganese Steel

Water Quenched					Oil Quenched				
Treatment Degrees Fahr.	Drawn	Tensile strength pounds per square inch	Elongation per cent	Bend test degrees	Treatment Degrees Fahr.	Drawn	Tensile strength pounds per square inch	Elongation per cent	Bend test degrees
1700	1300	103,200	4.7	...	1700	1300	101,100	8.5	60
	1100	106,700	3.0	...		1100	103,650	8.1	50
	900	121,000	2.7	...		900	109,300	6.8	30
1600	1300	97,500	10.2	90	1600	1300	90,000	19.7	180
	1100	102,000	8.0	30		1100	93,500	18.9	180
	900	115,000	7.5	30		900	100,250	16.3	120
1550	1300	94,000	12.1	120	1500	1300	94,400	21.2	180
	1100	98,500	6.3	40		1100	94,900	20.0	180
	900	107,400	6.1	30		900	99,750	17.5	150
1500	1300	93,000	11.1	120	1450	1300	92,200	21.4	180
	1100	96,300	7.9	60		1100	91,700	20.2	180
	900	98,900	6.8	60		900	96,400	18.7	160
1450	1300	98,000	12.0	100	1400	1300	84,000	13.3	90
	1100	102,400	9.1	75		1100	86,500	12.7	90
	900	109,600	5.3	30		900	83,750	9.5	60
1400	1300	86,000	7.2	45	1700	1300	92,000	9.5	90
	1100	89,300	5.1	...		1100	94,400	9.3	90
	900	91,100	4.0	...		900	97,350	8.9	60
1300	1300	88,100	8.3	...	1600	1300	91,750	22.5	180
	1100	90,500	8.0	...		1100	94,000	21.7	180
	900	93,200	7.7	...		900	96,250	20.3	180
					1500	1300	89,600	24.0	180
						1100	91,500	22.7	180
						900	92,000	19.6	180
					1400	1300	82,700	14.1	120
						1100	84,000	12.2	120
						900	84,500	11.9	90

*All tests made on standard test bars taken from heavy sectioned work. Thiner section would naturally show greater differences.

clusions, such as slag or sand, causing cracks to appear, often being internal and not appearing until the steel is in service. Consequently, the molding practice must be watched carefully, and all steel should be allowed to stand in the ladle at least ten minutes before pouring the first mold, bottom pour ladles being strongly recommended.

This steel does not exhibit any of its beneficial properties unless given a heat treatment. Small size castings may be water quenched with safety, large size work showing superior results when given an air quenching followed by a draw to the proper ductility.

Some interesting figures obtained on special manangese steel made in an acid electric furnace reflect the results obtainable by proper heat treating. An average of a number of tests made on steel of 0.25 to 0.30 per cent carbon, with manganese at 1.25 to 1.30 per cent showed tensile strength totals ranging from 82,000 to 92,000 pounds per square inch. Standard bend bars were used. When annealed and cooled slowly in the furnace from 1700 degrees, Fahr., the tensile strength was 92,000 pounds with an elongation of 11 per cent and a cold bend of 120 degrees. The same treatment from a maximum of 1600 degrees gave a lower tensile but with 17.5 per cent elongation and 130 degrees bend, while when the initial temperature was dropped to 1500 degrees, Fahr. the maximum elongation of 18.5 per cent with a bend of 130 degrees was attained. Below this temperature the tensile and other properties were decreased.

Table XLIX, accompanying gives results obtained on manganese steel of the analysis described in a series of tests, using either water or oil for quenching.

Manganese has a tendency to lower the critical temperatures of steel approximately 5 degrees Fahr. for each 0.10 per cent manganese. With a steel approximating 1.50 per cent manganese this would amount to 75 degrees Fahr. However, it may be seen from the tests shown in Table XLIX that on heavy sectioned work it may be treated safely as for a plain steel of equal carbon content. This steel is not particularly sensitive to small differences in the temperatures of either heating quenching, or drawing, which makes its use attractive to the shop operating under a heavy production schedule as these castings may be treated coincident with plain carbon pieces.

The accompanying tests, summarized in Table L, were reported by John Howe Hall in a paper for the American Institute of Mining and Metallurgical Engineers, cover a series of results on this steel as made in the basic electric furnace. All specimens were given the following treatment:

Air quenched from 900 degrees Cent. drawn back to 700 degrees Cent. and allowed to cool in the air.

Mr. Hall in the *Iron Age* of September 28, 1922 offers the results of a series of tests covering these high manganese steels in combination with nickel, the latter varying from 1.15 to 1.80 per cent. As would be expected these steel show the great ductility of the manganese combined with the high tensile strength and elastic limit of the nickel, producing a metal of unusual quality. In these tests the carbon content ranges from 0.27 to 0.38 per cent; the sulphur from 0.032 to 0.040 per cent; phosphorus from 0.035 to 0.045 per cent, and the silicon from 0.30 to 0.40 per cent. Copper from 0.40 to 0.80 per cent also is contained in the analyses listed. The results of these tests are summarized in Table L.

From the data given it may be seen what a great variety of alloys in their different combinations may be used, and what high test results may be had from their use. In the manufacture of alloy castings it is by far the best and safest method to use the steel requiring the simplest melting and treating procedure with the necessary qualifications amply to cover the specifications

Table L

Physical Properties of Manganese Steel

Carbon per cent	Silicon per cent	Manganese per cent	Tensile strength pounds per square inch	Elastic limit pounds per square inch	Elongation per cent	Reduction of area per cent
0.26	0.38	1.33	80,000	51,500	20.8	31.8
0.26	0.38	1.33	109,000	70,000	21.2	28.9
0.36	0.33	1.33	85,750	46,100	24.0	35.7
0.27	0.28	1.38	96,000	59,000	23.9	31.5
0.35	0.33	1.38	84,030	46,790	24.5	35.1
0.35	0.33	1.38	106,160	73,960	17.7	34.0
0.26	0.38	1.39	73,500	48,500	28.9	43.4
0.34	0.33	1.39	75,500	42,000	29.2	50.6
0.47	0.39	1.40	106,160	61,380	20.9	36.9
0.34	0.51	1.41	78,000	53,000	26.0	34.7
0.38	0.24	1.72	100,500	50,000	19.8	34.7
0.34	0.26	1.79	84,250	45,500	27.2	52.5
0.27	0.30	1.91	91,400	54,250	23.7	31.2
0.32	0.19	2.38	103,400	59,390	18.2	29.2

Issues Pyrometer Booklet

The Republic Flow Meters Co., Chicago has issued an attractive booklet describing its pyrometers and accessories. The booklet describes pyrometer applications in the production of steels for malleable iron glass and for annealing gas plant operation, gas producers, coke ovens, enameling processes and chemical plants, etc. Valuable information is given covering the correct interpretation of pyrometer readings, pyrometer maintenance, cold junction errors, and how they are eliminated together with charts of recommended heat treatments for S. A. E. carbon and alloy steel specifications and a color-temperature scale ranging from 900 to 2200 degrees Fahr. Conversion tables covering the fahrenheit and centigrade scales are given together with the melting points of the most important chemical elements.

Table LI

Properties of Manganese-Nickel Steel

Manganese per cent	Nickel per cent	Tensile strength pounds per square inch	Elastic limit pounds	Elongation per cent	Reduction Area per cent	Bend degrees
0.81	1.60	92,283	55,767	22	37	120
0.93	1.44	92,334	55,003	21	31	120
1.02	1.15	88,616	54,494	25	40	120
1.04	1.14	92,691	56,277	22	34	120
1.11	1.34	95,543	59,078	22	37	120
0.93	1.12	90,042	57,550	23	37	120
1.18	1.60	92,691	55,003	22	36	120
1.15	1.58	94,830	54,748	22	37	120
1.03	1.73	96,052	59,087	25	41	120
1.21	1.24	91,366	55,003	25	44	120
1.15	1.54	81,343	60,096	25	41	120
1.15	1.80	92,181	55,288	23	36	120

T. J. Barry has been appointed representative in the Pittsburgh district of the Pennsylvania Pump & Compressor Co., Easton, Pa.

Apply Test Methods To Aid in Controlling Sands in Foundries

Many Casting Losses Eliminated Through Application of Tests Determining the Various Properties of Sand

By H. W. Dietert

PROPER control of molding sands is considered an essential factor in reducing losses in the foundry. Recognizing this fact, individuals, companies and associations interested have been working to develop means for controlling conditions in the shop, and a number of manufacturing concerns have installed laboratories to test the sand. In this paper, which was presented at the Milwaukee convention of the American Foundrymen's association, October, 1924, the author describes the tests being conducted at the plant of the United States Radiator Corp., Detroit. The author is connected with the engineering department of that company.

FOUNDRY losses may be divided into four classes, namely, iron, equipment, labor and sand losses. The losses due to sand, directly or indirectly, may be largest in some cases. All the above named classified losses are increased to a large extent by adverse sand conditions. When the sand is tempered correctly with the amount of water giving sand its best working texture and maximum permeability or venting quality, a much duller iron may be poured than if the sand either was too dry or too wet. Maximum permeability for a specific job may be obtained by the proper addition of new sand and by tempering sand with the right amount of water. Both of these properties are controlled best by test methods later described.

The loss due to equipment also may be reduced by using an adaptable sand. An adaptable sand for a particular job is one possessing properties which allow for deformation and strain produced by the nature or quality of equipment.

The labor loss also is related remarkably to sand conditions. Suppose the molder finds his sand too dry or too wet, either of which will produce a dense and weak sand of poor working texture, he immediately is discouraged and counts on a bad day's work. This psychological effect undoubtedly will be indicated in the day's loss.

How to get good sand conditions each day which are adapted exactly for the job is a problem. Sand control testing partly will answer the question by its application to the daily foundry practice. This enables foundrymen to get numerical figures expressing the physical properties of the sand used, or to be used. The physical properties which are determined for control work are permeability, strength, and moisture. The fineness test is a valuable addition to this list.

The following are the values found desirable for boiler molding sand: permeability 35 to 45, compressive strength 2 to 3¼ pounds, and moisture, 7 to 8 per cent. These physical properties are kept within the working range by the proper addition of adaptable new sand as open sand, or bonding sand, and by correct tempering.

The figures obtained from sand control testing are of no value unless the foundryman will apply and study them by correlating daily with his losses. Following this practice, the range of permissible variation of physical propertes of his heap sand that will give him the best results in practice soon is determined. After this range once is determined, it is a fairly easy task to keep his sand within the chosen limits.

The permeability of the molding sand is determined by the use of the American Foundrymen's association standard permeability apparatus. The procedure of test method used in the laboratory is in accordance with the American Foundrymen's association methods.

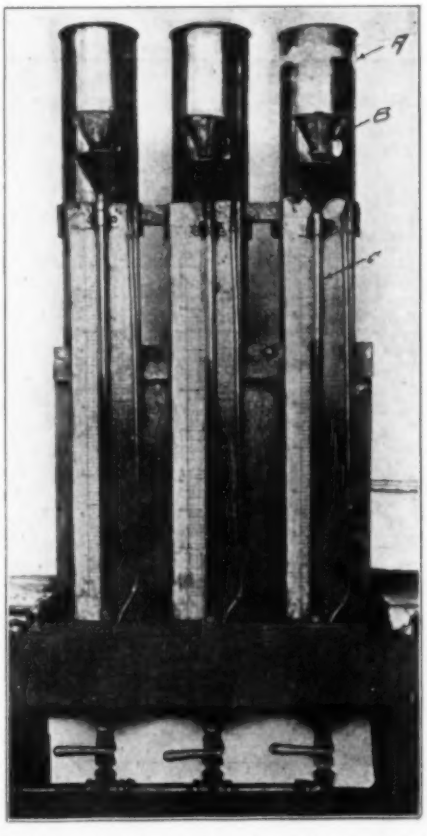


FIG. 1—APPARATUS NECESSARY TO DETERMINE THE MOISTURE

The fineness test is also in accordance with the American Foundrymen's association test method with the following exception: a 300-gram sample of sand is used in place of the 50-gram sample. This is used that a sufficient amount of sand grains are obtained, after the clay substance is removed, to make a standdard permeability test specimen from the sand grains. The permeability of the sand grains is called the base permeability.

The procedure of the heat test or durability test is to heat a sample of the sand in a furnace to 600 degrees Fahr. for a period of two hours. The loss in strength and permeability change is expressed in percentage. This test is used to give the life of new sands submitted.

The cohesiveness of the sand is determined by a compression test. The word strength is used in place of the word cohesiveness, for the word strength conveys a definite meaning due to its universal use in material testing. The strength of molding sand is expressed in pounds per square inch, which is both conventional and simple.

The strength test is made by filling a cylindrical mold 1⅛ inches in diameter, *A* Fig. 5, with the sand to be tested. The mold containing the sand is placed under the rammer, *B* Fig. 5. A stop pin is removed from the bottom supporting post of the mold. The sand in the mold is rammed by raising the weight, *C* Fig. 5, to the top stop *D*, and allowing it to fall from this position. Since the mold is free to move on the bottom supporting post, the sand specimen is rammed from

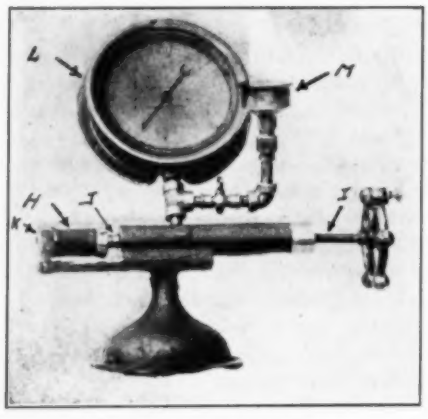


FIG. 2—THE COMPRESSION MACHINE CREATES AN OIL PRESSURE ON TURNING THE PLUNGER *I*

both ends, producing a uniformly rammed specimen.

The top of the ramming rod should be within the two tolerance marks, *E* Fig. 5, to give a test specimen from 1.75 to 2.00 inches in length. Specimens within this range of length are of the correct theoretical and practical length to give true compressive strength and consistent values with diameter of 1⅛ inches. The lengths of the rammed specimens are obtained easily by placing the stop pin of the supporting post of the mold in one of the various holes, so that the amount of sand which the mold will hold is gaged.

The test specimens are removed from the mold by stripping the mold over

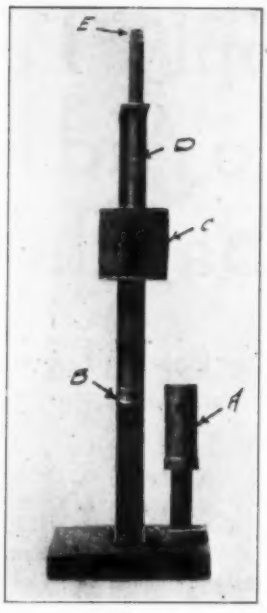


FIG. 5—A MACHINE RAMS THE COMPRESSION TEST SPECIMEN

the supporting post. This operation will cause the test specimen to be stripped free from the mold. The test specimen, *H* Fig. 2, is picked up by hand and placed in the testing machine as shown in Fig. 2. The test machine consists of a screw plunger *I* which upon turning creates an oil pressure on the

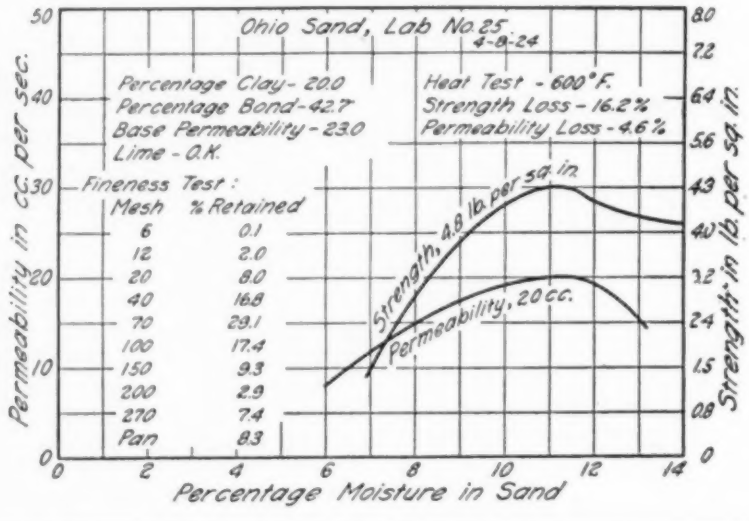


Fig. 3—Characteristic Curves Show the Maximum Permeability. Fig. 4—A Sand Analysis Comparison Sheet Used in Car Lot Shipments of Molding Sand

SAND ANALYSIS COMPARISON

SAND Woden
SHIPPERS C.C. Hatch DATE 5-9-24
SHIPPING POINT Vandalia, N.Y. PLANT Dunkirk
CAR NO. N.Y.C. 6422 TESTED BY

CHARACTERISTIC	ANALYSIS: SAMPLE	ANALYSIS: CARLOAD	REMARKS
Permeability-Moisture	21.0 @ 9½%	22.5 @ 9½%	
Strength-Moisture	3.0 lb @ 9½%	3.4 lb @ 9½%	
Percentage Bond	41	39	
Base Permeability	20	22	
Percentage Clay	9.7	9.6	
Lime	✓	✓	
Heat Test, deg. F.			
Strength Loss	20.0%	20.7%	
Permeability Gain	52%	55%	
Fineness Test:—			
6	——	——	
12	——	——	
20	0.5	0.2	
40	2.2	0.6	
70	12.7	14.9	
100	24.9	39.7	
150	26.8	22.0	
200	9.0	6.7	
270	15.0	9.5	
Pan	11.5	11.8	

oil floating piston *J*. At the head of this piston *J*, and at the end rest *K*, are mounted ball socketed bearing plates to equalize load application on the test specimen. The oil pressure on the piston *J*, or that which is supported by the sand specimen, is indicated by the gage *L* in pounds per square inch strength of the sand. The cup *M* is used to replenish the oil supply in the system.

The procedure of the test after the specimen is placed in the test machine is as follows: The hand wheel of the screw plunger *I* is turned by hand at the rate of 40 revolutions per minute. Consistent test readings are obtained easily by this hand operation. As the hand wheel is turned the oil pressure will increase, producing an increasing load upon the sand test specimen. The specimen of sand will break suddenly when the load reaches the ultimate strength of the sand. The operator records the maximum reading of the gage *L*. The advantages of this strength test are the rapid-

BRINELL HARDNESS NUMBERS*

(*Continued from Data Sheet No. 570*)

DIAMETER OF BALL, 10 MILLIMETERS
LOAD, 500 AND 3,000 KILOGRAMS

Diameter indentation	Brinell hardness numbers: At 500-kilogram load	At 3000-kilogram load	Diameter indentation	Brinell hardness numbers: At 500-kilogram load	At 3000-kilogram load	Diameter indentation	Brinell hardness numbers: At 500-kilogram load	At 3000-kilogram load	Diameter indentation	Brinell hardness numbers: At 500-kilogram load	At 3000-kilogram load	Diameter indentation	Brinell hardness numbers: At 500-kilogram load	At 3000-kilogram load
mm			mm			mm			mm			mm		
2.00	158	945	2.50	100.0	601	3.00	69.1	415	3.50	50.3	302	4.00	38.1	229
2.01	156	936	2.51	99.4	597	3.01	68.6	412	3.51	50.0	300	4.01	37.9	228
2.02	154	926	2.52	98.6	592	3.02	68.2	409	3.52	49.7	298	4.02	37.7	226
2.03	153	917	2.53	97.8	587	3.03	67.7	406	3.53	49.4	297	4.03	37.5	225
2.04	151	908	2.54	97.1	582	3.04	67.3	404	3.54	49.2	295	4.04	37.3	224
2.05	150	899	2.55	96.3	578	3.05	66.8	401	3.55	48.9	293	4.05	37.1	223
2.06	148	890	2.56	95.5	573	3.06	66.4	398	3.56	48.6	292	4.06	37.0	222
2.07	147	882	2.57	94.8	569	3.07	65.9	395	3.57	48.3	290	4.07	36.8	221
2.08	146	873	2.58	94.0	564	3.08	65.5	393	3.58	48.0	288	4.08	36.6	219
2.09	144	865	2.59	93.3	560	3.09	65.0	390	3.59	47.7	286	4.09	36.4	218
2.10	143	856	2.60	92.6	555	3.10	64.6	388	3.60	47.5	285	4.10	36.2	217
2.11	141	848	2.61	91.8	551	3.11	64.2	385	3.61	47.2	283	4.11	36.0	216
2.12	140	840	2.62	91.1	547	3.12	63.8	383	3.62	46.9	282	4.12	35.8	215
2.13	139	832	2.63	90.4	543	3.13	63.3	380	3.63	46.7	280	4.13	35.7	214
2.14	137	824	2.64	89.7	538	3.14	62.9	378	3.64	46.4	278	4.14	35.5	213
2.15	136	817	2.65	89.0	534	3.15	62.5	375	3.65	46.1	277	4.15	35.3	212
2.16	135	809	2.66	88.4	530	3.16	62.1	373	3.66	45.9	275	4.16	35.1	211
2.17	134	802	2.67	87.7	526	3.17	61.7	370	3.67	45.6	274	4.17	34.9	210
2.18	132	794	2.68	87.0	522	3.18	61.3	368	3.68	45.4	272	4.18	34.8	209
2.19	131	787	2.69	86.4	518	3.19	60.9	366	3.69	45.1	271	4.19	34.6	208
2.20	130	780	2.70	85.7	514	3.20	60.5	363	3.70	44.9	269	4.20	34.4	207
2.21	129	772	2.71	85.1	510	3.21	60.1	361	3.71	44.6	268	4.21	34.2	205
2.22	128	765	2.72	84.4	507	3.22	59.8	359	3.72	44.4	266	4.22	34.1	204
2.23	126	758	2.73	83.8	503	3.23	59.4	356	3.73	44.1	265	4.23	33.9	203
2.24	125	752	2.74	83.2	499	3.24	59.0	354	3.74	43.9	263	4.24	33.7	202
2.25	124	745	2.75	82.6	495	3.25	58.6	352	3.75	43.6	262	4.25	33.6	201
2.26	123	738	2.76	81.9	492	3.26	58.3	350	3.76	43.4	260	4.26	33.4	200
2.27	122	732	2.77	81.3	488	3.27	57.9	347	3.77	43.1	259	4.27	33.2	199
2.28	121	725	2.78	80.8	485	3.28	57.5	345	3.78	42.9	257	4.28	33.1	198
2.29	120	719	2.79	80.2	481	3.29	57.2	343	3.79	42.7	256	4.29	32.9	198
2.30	119	712	2.80	79.6	477	3.30	56.8	341	3.80	42.4	255	4.30	32.8	197
2.31	118	706	2.81	79.0	474	3.31	56.5	339	3.81	42.2	253	4.31	32.6	196
2.32	117	700	2.82	78.4	471	3.32	56.1	337	3.82	42.0	252	4.32	32.4	195
2.33	116	694	2.83	77.9	467	3.33	55.8	335	3.83	41.7	250	4.33	32.3	194
2.34	115	688	2.84	77.3	464	3.34	55.4	333	3.84	41.5	249	4.34	32.1	193
2.35	114	682	2.85	76.8	461	3.35	55.1	331	3.85	41.3	248	4.35	32.0	192
2.36	113	676	2.86	76.2	457	3.36	54.8	329	3.86	41.1	246	4.36	31.8	191
2.37	112	670	2.87	75.7	454	3.37	54.4	326	3.87	40.9	245	4.37	31.7	190
2.38	111	665	2.88	75.1	451	3.38	54.1	325	3.88	40.6	244	4.38	31.5	189
2.39	110	659	2.89	74.6	448	3.39	53.8	323	3.89	40.4	242	4.39	31.4	188
2.40	109	653	2.90	74.1	444	3.40	53.4	321	3.90	40.2	241	4.40	31.2	187
2.41	108	648	2.91	73.6	441	3.41	53.1	319	3.91	40.0	240	4.41	31.1	186
2.42	107	643	2.92	73.0	438	3.42	52.8	317	3.92	39.8	239	4.42	30.9	185
2.43	106	637	2.93	72.5	435	3.43	52.5	315	3.93	39.6	237	4.43	30.8	185
2.44	105	632	2.94	72.0	432	3.44	52.2	313	3.94	39.4	236	4.44	30.6	184
2.45	104	627	2.95	71.5	429	3.45	51.8	311	3.95	39.1	235	4.45	30.5	183
2.46	104	621	2.96	71.0	426	3.46	51.5	309	3.96	38.9	234	4.46	30.3	182
2.47	103	616	2.97	70.5	423	3.47	51.2	307	3.97	38.7	232	4.47	30.2	181
2.48	102	611	2.98	70.1	420	3.48	50.9	306	3.98	38.5	231	4.48	30.0	180
2.49	101	606	2.99	69.6	417	3.49	50.6	304	3.99	38.3	230	4.49	29.9	179

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(*Concluded on Data Sheet No. 572*)

BRINELL HARDNESS NUMBERS

(*Concluded from Data Sheet No. 571*)

DIAMETER OF BALL, 10 MILLIMETERS
LOAD, 500 AND 3,000 KILOGRAMS

Diameter indentation	Brinell hardness numbers: At 500-kilogram load	At 3000-kilogram load	Diameter indentation	Brinell hardness numbers: At 500-kilogram load	At 3000-kilogram load	Diameter indentation	Brinell hardness numbers: At 500-kilogram load	At 3000-kilogram load	Diameter indentation	Brinell hardness numbers: At 500-kilogram load	At 3000-kilogram load	Diameter indentation	Brinell hardness numbers: At 500-kilogram load	At 3000-kilogram load
mm			mm			mm			mm			mm		
4.50	29.8	179	5.00	23.8	143	5.50	19.3	116	6.00	15.9	95.5	6.50	13.3	79.6
4.51	29.6	178	5.01	23.7	142	5.51	19.2	115	6.01	15.9	95.1	6.51	13.2	79.3
4.52	29.5	177	5.02	23.6	141	5.52	19.2	115	6.02	15.8	94.8	6.52	13.2	79.0
4.53	29.3	176	5.03	23.5	141	5.53	19.1	114	6.03	15.7	94.4	6.53	13.1	78.7
4.54	29.2	175	5.04	23.4	140	5.54	19.0	114	6.04	15.7	94.1	6.54	13.1	78.4
4.55	29.1	174	5.05	23.3	140	5.55	18.9	114	6.05	15.6	93.7	6.55	13.0	78.2
4.56	28.9	174	5.06	23.2	139	5.56	18.9	113	6.06	15.6	93.4	6.56	13.0	77.9
4.57	28.8	173	5.07	23.1	138	5.57	18.8	113	6.07	15.5	93.0	6.57	12.9	77.6
4.58	28.7	172	5.08	23.0	138	5.58	18.7	112	6.08	15.4	92.7	6.58	12.9	77.3
4.59	28.5	171	5.09	22.9	137	5.59	18.6	112	6.09	15.4	92.3	6.59	12.8	77.1
4.60	28.4	170	5.10	22.8	137	5.60	18.6	111	6.10	15.3	92.0	6.60	12.8	76.8
4.61	28.3	170	5.11	22.7	136	5.61	18.5	111	6.11	15.3	91.7	6.61	12.8	76.5
4.62	28.1	169	5.12	22.6	135	5.62	18.4	110	6.12	15.2	91.3	6.62	12.7	76.2
4.63	28.0	168	5.13	22.5	135	5.63	18.3	110	6.13	15.2	91.0	6.63	12.7	76.0
4.64	27.9	167	5.14	22.4	134	5.64	18.3	110	6.14	15.1	90.6	6.64	12.6	75.7
4.65	27.8	167	5.15	22.3	134	5.65	18.2	109	6.15	15.1	90.3	6.65	12.6	75.4
4.66	27.6	166	5.16	22.2	133	5.66	18.1	109	6.16	15.0	90.0	6.66	12.5	75.2
4.67	27.5	165	5.17	22.1	133	5.67	18.1	108	6.17	14.9	89.6	6.67	12.5	74.9
4.68	27.4	164	5.18	22.0	132	5.68	18.0	108	6.18	14.9	89.3	6.68	12.4	74.7
4.69	27.3	164	5.19	21.9	132	5.69	17.9	107	6.19	14.8	89.0	6.69	12.4	74.4
4.70	27.1	163	5.20	21.8	131	5.70	17.8	107	6.20	14.8	88.7	6.70	12.4	74.1
4.71	27.0	162	5.21	21.7	130	5.71	17.8	107	6.21	14.7	88.3	6.71	12.3	73.9
4.72	26.9	161	5.22	21.6	130	5.72	17.7	106	6.22	14.7	88.0	6.72	12.3	73.6
4.73	26.8	161	5.23	21.6	129	5.73	17.6	106	6.23	14.6	87.7	6.73	12.2	73.4
4.74	26.6	160	5.24	21.5	129	5.74	17.6	105	6.24	14.6	87.4	6.74	12.2	73.1
4.75	26.5	159	5.25	21.4	128	5.75	17.5	105	6.25	14.5	87.1	6.75	12.1	72.8
4.76	26.4	158	5.26	21.3	128	5.76	17.4	105	6.26	14.5	86.7	6.76	12.1	72.6
4.77	26.3	158	5.27	21.2	127	5.77	17.4	104	6.27	14.4	86.4	6.77	12.1	72.3
4.78	26.2	157	5.28	21.1	127	5.78	17.3	104	6.28	14.4	86.1	6.78	12.0	72.1
4.79	26.1	156	5.29	21.0	126	5.79	17.2	103	6.29	14.3	85.8	6.79	12.0	71.8
4.80	25.9	156	5.30	20.9	126	5.80	17.2	103	6.30	14.2	85.5	6.80	11.9	71.6
4.81	25.8	155	5.31	20.9	125	5.81	17.1	103	6.31	14.2	85.2	6.81	11.9	71.3
4.82	25.7	154	5.32	20.8	125	5.82	17.0	102	6.32	14.1	84.9	6.82	11.8	71.1
4.83	25.6	154	5.33	20.7	124	5.83	17.0	102	6.33	14.1	84.6	6.83	11.8	70.8
4.84	25.5	153	5.34	20.6	124	5.84	16.9	101	6.34	14.0	84.3	6.84	11.8	70.6
4.85	25.4	152	5.35	20.5	123	5.85	16.8	101	6.35	14.0	84.0	6.85	11.7	70.4
4.86	25.3	152	5.36	20.4	123	5.86	16.8	101	6.36	13.9	83.7	6.86	11.7	70.1
4.87	25.1	151	5.37	20.3	122	5.87	16.7	100	6.37	13.9	83.4	6.87	11.6	69.9
4.88	25.0	150	5.38	20.3	122	5.88	16.7	99.9	6.38	13.8	83.1	6.88	11.6	69.6
4.89	24.9	150	5.39	20.2	121	5.89	16.6	99.5	6.39	13.8	82.8	6.89	11.6	69.4
4.90	24.8	149	5.40	20.1	121	5.90	16.5	99.2	6.40	13.7	82.5	6.90	11.5	69.2
4.91	24.7	148	5.41	20.0	120	5.91	16.5	98.8	6.41	13.7	82.2	6.91	11.5	68.9
4.92	24.6	148	5.42	19.9	120	5.92	16.4	98.4	6.42	13.6	81.9	6.92	11.4	68.7
4.93	24.5	147	5.43	19.9	119	5.93	16.3	98.0	6.43	13.6	81.6	6.93	11.4	68.4
4.94	24.4	146	5.44	19.8	119	5.94	16.3	97.7	6.44	13.5	81.3	6.94	11.4	68.2
4.95	24.3	146	5.45	19.7	118	5.95	16.2	97.3	6.45	13.5	81.0	6.95	11.3	68.0
4.96	24.2	145	5.46	19.6	118	5.96	16.2	96.9	6.46	13.4	80.7	6.96	11.3	67.7
4.97	24.1	144	5.47	19.5	117	5.97	16.1	96.6	6.47	13.4	80.4	6.97	11.3	67.5
4.98	24.0	144	5.48	19.5	117	5.98	16.0	96.2	6.48	13.4	80.1	6.98	11.2	67.3
4.99	23.9	143	5.49	19.4	116	5.99	16.0	95.9	6.49	13.3	79.8	6.99	11.2	67.0

THE FOUNDRY DATA SHEET, MAY 1, 1925
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

Around the World with The Foundry

Little Journeys to the homes of our readers

Canada

EXTENDING from the 49th parallel of latitude to the Arctic ocean and from the Atlantic to the Pacific, with the area of 3½ million square miles, the Dominion of Canada is the largest political division in the western hemisphere and the largest single unit in the group that goes to make up the far flung British empire.

Considering her vast natural resources—placer mines in the Yukon that rival the famed Golconda; copper and nickel deposits in Ontario; asbestos in Quebec; fisheries on the Atlantic and Pacific coasts that are not equalled elsewhere on earth and vast forests of lumber and pulp wood, it is only reasonable to infer that in the years to come, years that now lie dormant in the womb of time, Canada will be one of the greatest manufacturing nations in the world.

Blast furnaces and steel plants have been installed at various points and some of her coal mines on the eastern seaboard are among the oldest in North America. The foundries of Canada have kept pace with her industrial expansion and are adequate for all her needs. Shop practice is similar to that in the United States probably owing to the fact that inspiration is drawn from the same source, The Foundry, which is delivered twice a month to 259 of the influential men who direct the destinies of the 530 casting plants in the Dominion.

From Sydney to Vancouver and from Hudson Bay to the Great Lakes

"Wherever metals are cast you'll find THE FOUNDRY"

ity of test, and simplicity and accuracy of test readings obtained. Strength readings may be obtained at the rate of one a minute with a small amount of manual effort.

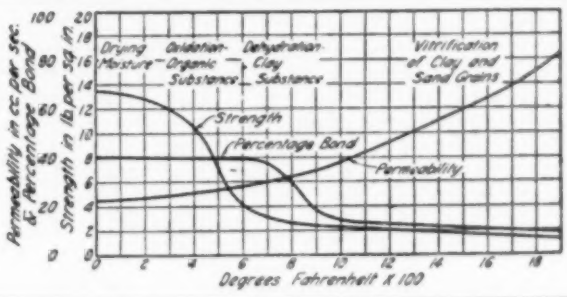
Moisture in new samples of sand is determined by drying the sample of sand in an oven. For foundry control work, this method is slow and the small sample of sand used is not always representative of the heap sand. A volumetric method is used to determine the moisture control in the heap sand. This method gives moisture percentage in approximately 2 minutes and employs a 860-gram sample of sand.

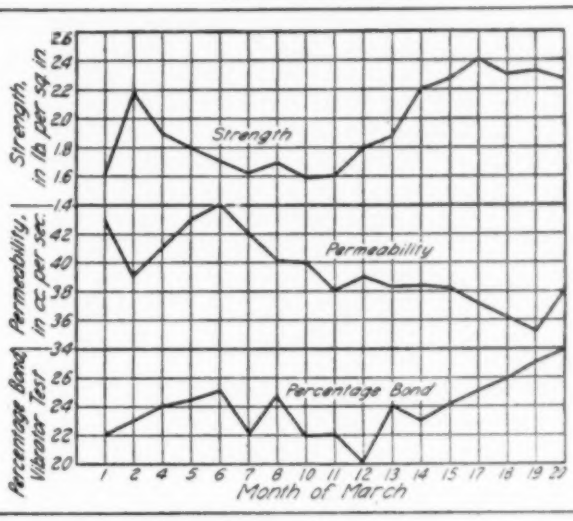
The apparatus used in this volumetric moisture determination is shown in Fig. 1. It consists of a cylindrical flask having a side outlet *B*. This outlet *B* is located directly above the glass tube *C*. Along the side of this tube a scale reading in percentages of moisture is attached. The glass tube *C* contains a bulb and a stop cock on its lower end. It may be noted that in Fig. 1, three moisture tubes are assembled on a common base. The number of tubes used is governed by the number of samples it is desired to test at one time.

A moisture determination is made by placing the 860-gram sample of sand in the top flask *A*, which previously has been filled with water. The water displaced by the sample of sand is caught in the glass tube assembly *C*. The height of the water column in the tube *C*, resulting from this overflow of water, gives the moisture reading. The principle involved in this method is that a definite amount of water will be displaced for each percentage of water contained in the sand. A dry sample of sand will displace a small amount of water, while a wet sample will displace a larger amount. Employing this method for determination of moisture in sand heaps gives the operator a chance to make immediate moisture adjustment of the sand.

Sand salesmen are requested to submit representative gallon samples of the prospective sands, which they know may be duplicated in carlot shipments to within 20 per cent of test reading. It often has been the custom of the sand producer to see how many sand samples could be found in his pits, never being able or intending to duplicate in carlot shipments. To determine the most adaptable sands for each class of work, such as radiation, boiler and plate work, the sample furnished is tested for the following physical properties:

1. The determination of permeability and strength for each percentage of moisture variation over the possible working range.
2. The percentage of clay contained.
3. The fineness of sand grains.





SAND CONTROL TEST SHEET

PLANT Detroit SECTION Radiator DATE 6-24-24

Floor No.	Permeability	Strength lb per sq in	Bond per cent	Moisture per cent			Remarks
				Front	Center	End	
1	23.5	2.70					
2	23.5	2.75		62	67	7.0	
3	22.0	2.50		63	65	6.5	
4	24.0	2.50		61	67	6.4	
5	25.0	2.75		61	64	6.4	
6	21.5	2.70		64	69	6.3	
7	20.0	2.90		7.0	6.4	7.0	
8	23.0	3.00		6.7	6.2	6.9	
9	20.0	3.10		6.4	6.9	6.4	
10	20.0	3.25		7.0	7.3	7.1	
11	18.0	3.25		7.2	7.0	7.1	
12	21.5	2.50		6.9	7.0	7.1	
13	22.0	2.75		7.1	7.2	7.2	
14	21.5	2.90		6.7	6.5	6.9	
15	24.0	3.15		6.4	6.4	6.3	
16	28.0	2.75		6.0	6.1	6.2	
21	27.5	2.75		6.7	6.9	6.5	
22	29.0	3.00		6.1	6.1	6.0	
23	25.0	3.00		6.0	6.9	6.2	
24	25.0	3.00		6.1	6.1	6.2	
25	23.0	2.75		6.7	6.1	6.4	
26	27.0	2.75		6.1	6.3	6.7	
27	25.0	2.60		6.4	5.7	6.0	

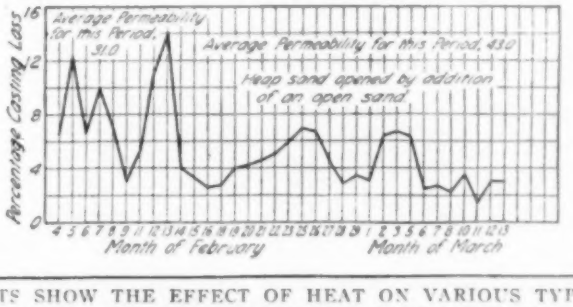

Average Permeability for this Period, 31.0
Average Permeability for this Period, 43.0
Heap sand opened by addition of an open sand
Percentage Casting Loss
Month of February
Month of March

FIG. 6—CHARTS SHOW THE EFFECT OF HEAT ON VARIOUS TYPES OF SAND. FIG. 7—PHYSICAL PROPERTIES OF THE SAND OF ONE FLOOR. FIG. 8 SAND CONTROL SHEET SHOWING THE PERMEABILITY, STRENGTH AND MOISTURE OF THE SAND ON ONE FLOOR. FIG. 9—REDUCTION OF THE BOILER SECTION LOSS BY INCREASING THE PERMEABILITY OF THE HEAP SAND

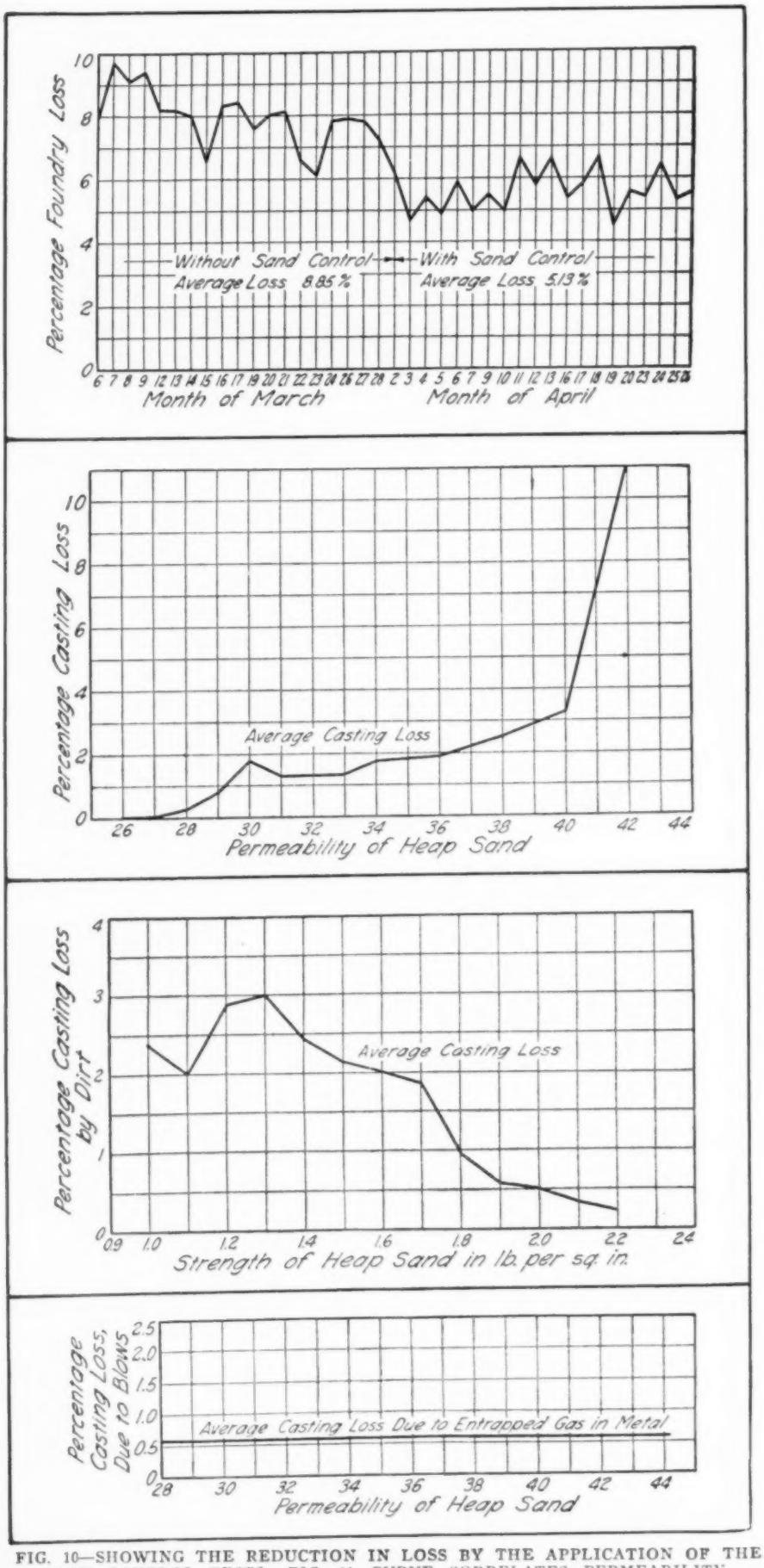

Percentage Foundry Loss
Without Sand Control
Average Loss 8.85%
With Sand Control
Average Loss 5.13%
Month of March
Month of April
Percentage Casting Loss
Average Casting Loss
Permeability of Heap Sand
Percentage Casting Loss by Dirt
Average Casting Loss
Strength of Heap Sand in lb. per sq. in.
Percentage Casting Loss Due to Blows
Average Casting Loss Due to Entrapped Gas in Metal
Permeability of Heap Sand

FIG. 10—SHOWING THE REDUCTION IN LOSS BY THE APPLICATION OF THE SAND CONTROL TESTS. FIG. 11—CURVE CORRELATES PERMEABILITY OF HEAP SAND WITH CASTINGS LOST. FIG. 12—DIRT LOSSES DECREASED BY INCREASING STRENGTH OF HEAP SAND. FIG. 13—CHART SHOWING THAT INCREASING PERMEABILITY OF SAND DOES NOT DECREASE THE LOSS DUE TO BLOWS FROM ENTRAPPED GAS

4. The base permeability of sand grains.
5. Test for lime.
6. The heat test, a determination of the life of the sand.

The permeability and strength readings are plotted versus moisture as shown in Fig. 3. These characteristic curves show the maximum permeability 20 cubic centimeters and maximum strength 4.8 pounds both occur at 11 per cent of moisture. The curve also shows that this sand is not greatly affected by moisture variation. It takes a change of 3½ per cent of moisture variation to make a change of 2½ cubic centimeters in permeability. Thus, this sand is spoken of as possessing a moisture working range of 3½. Some sands require a variation of 7 per cent of moisture to change permeability 2½ cubic centimeters. These sands are tempered easily. Sands having a moisture working range of less than 1½ are difficult to temper in the heap. The results of all the other tests are tabulated on the same sheet with strength and permeability curves as shown in Fig. 3. It may be noted that the percentage of bond as determined by vibratory test is approximately the sum of the percentage of clay and sand grains retained on the screen No. 270 and the pan.

The base permeability of the sand grains is determined after the clay substance is removed. The clean sand grains are rammed in the permeability specimen retainer and held in place by No. 70 screens on each end. The permeability reading will indicate the openness of the sand grain structure. Some sands have a grain size distribution which forms a dense structure, while others have sand grain sizes distributed which pack into an open structure. A large amount of 270 or pan material will form dense grain structure.

The base permeability is of utmost importance, for it compares the permeability of all sands under like conditions. Some high clay sands are dense due to the amount of clay they contain. If natural permeability is the only consideration given, we would class these sands as closing-up sands for heap sand, while in reality they may have an open grain structure which would be shown in base permeability reading. When the clay content of this sand is reduced by mixing it into the heap, its open grain structure would act as an opener. All new sand placed in a heap sand will be brought to some predetermined clay content by sand control. To determine what the various new sands will do to a heap sand, they should be tested for permeability under a like condition, called the base permeability.

The fineness of molding sand is indeed valuable in the grading of sands as to their coarseness. The grain distribution

and their relation to the permeability and casting properties, as finish and resistance to washing, should also receive consideration. The amount of fine material as 270 and pan indicates its tendency to wash, and also the strength at which the particular sand should be worked in the heap.

The determination of the life of a molding sand by a heat test seems to be reliable. Molding sands have been tested which have lost as much as 87 per cent of their strength upon heating to 600 degrees for a period of two hours. Surely a molding sand that loses such a large percentage of its original strength would quickly lose its strength or bond in the heap. Several sands have shown exceedingly low strength loss upon heating, while a few have actually suffered no loss in strength, indicating a very durable sand.

In Fig. 3 it may be noted that the sand laboratory No. 25 lost 16.2 per cent of its strength and lost 4.6 per cent in permeability in the heat test. This sand is classed as a durable sand. It may be stated that all sands do not lose in permeability in the heat test, for a large number gain permeability.

Each car of sand received is sampled and tested for strength and permeability to insure receiving the specific type of sand ordered, and to check the uniformity of sand received. These test values are filed and form a valuable reference. The method used to check carlot shipments is as follows: An average sample of the sand is obtained. The sample is dried in the oven, and, after cooling, an amount of water is added which will give the sample of sand the same moisture percentage as that shown by characteristic curve to give temper. For example, for the checking of a carlot of sand supposed to be the same as sand laboratory No. 25, Fig. 3, 11 per cent water is added. The sample is mixed well and tested for permeability and strength. The strength and permeability should be respectively 4.8 and 20. Shipments are met easily at 15 per cent variation. Cars are rejected when properties vary more than 20 per cent.

When the strength and permeability reading approach those of the original sample, it is safe to state that the percentage of clay and fineness check closely. For this reason it is sufficient to make only the permeability and strength test of cars received. However, for cars rejected, and for a more complete check, a complete comparison analysis may be made. A copy of the sand analysis comparison sheet is shown in Fig. 4. It may be noted that the carlot shipment agrees closely with sample furnished of this sand.

The rejection of sand has been largely eliminated by a better understanding on part of the producer of the sand desired and his good will to meet definite requirements.

Make Vibratory Test

The vibratory test was made in conjunction with the permeability and strength tests for over a period of three months to determine the merits of each test. The conclusion which may be drawn from the comparison of the test data obtained will be discussed in the following.

In the analysis of new sands, it was found that sands containing a large portion of fine material, as 270 and pan material, always showed a higher percentage of bond in proportion to actual strength. Nearly all sand showed a larger amount of bond by vibratory test than the actual amount of clay substance. A part of the bond measured in the vibratory test is pan material.

Samples of a Zanesville sand were heated to various temperatures ranging from air dried to 1900 degrees Fahr. The strength, permeability, and percentage of bond by vibratory test were determined for each sample after being cooled and tempered. The result of this test is shown graphically in Fig. 6. It may be noted that the permeability of the sand increased rapidly after the sand samples were heated beyond 212 degrees Fahr. The strength loss due to heating sand up to 212 degrees Fahr. was 0.8 pounds. A rapid decrease in strength was found after sand was heated from 212 degrees to 700 degrees Fahr. After a temperature of 700 degrees, the strength decreased slowly. The percentage of bond remained constant until 700 degrees Fahr. was reached. From 700 to 1000 degrees Fahr. a marked decrease in percentage of bond was noted.

A comparison of the strength and percentage of bond curve in Fig. 6 shows that the vibratory test does not always show active bonding material or cohesiveness. The tabulation of strength and bond losses in percentage for various degrees of heat in the accompanying table show that the bond loss in percentage does not agree with the strength loss in percentage. The vibratory test measures the volume of fine material, such as clay substance and pan material, and not the binding quality of this material. The vibratory test did not show a decrease in bond until the volume of the so-called bond was reduced by the action of the heat at 1000 degrees Fahr. The percentage of bond cannot be used in the comparison of a varied class of new sands, to indicate the relative strength of the sands.

The vibratory test presents each sand for visual examination from which the foundryman may get a helpful general knowledge. This should lead to a desire to know definitely in numerical values each physical property of the sand, such as strength, permeability, fineness and others. The vibratory test, when applied to daily sand control of the heap sand, offers a much improved method over the old grab guess method. However, the more detailed test of the American Foundrymen's association offers a method which is a step ahead of the vibratory method. it is unfortunate that the vibratory method was not introduced some time ago because it is a splendid introduction to the more detailed American Foundrymen's association methods which give, definitely, the permeability, cohesiveness, fineness, etc.

In our control work, it was found that the permeability and strength tests could be made much quicker and, with less calculation than the vibratory test. The dividing line between the bond and grain material in the vibratory test does not show clearly in burnt sand. The readings from day to day of the bond were not as consistent as the strength and permeability readings. This is clearly shown in Fig. 7. Making a vibratory test on a large number of floors is a tremendous job when compared to the ease and neatness of permeability and strength tests. The strength, permeability and percentage of bond curves are shown in Fig. 7 for No. 3 boiler floor during the month of March. These curves are representative of a mass of similar curves for various floors at different times of the year.

The strength and permeability curves in Fig. 7 are related to a marked degree. For example, an increase in strength is accompanied by a decrease of permeability. This relation undoubtedly exists due to the amount of clay being a factor of the permeability. A comparison of the percentage of bond with either permeability or strength, shows no relation for the first part of

Comparison of Strength and Bond

Degrees Fahr. heat	Per centage loss in strength	Percentage loss in bond
212	0.59	0.0
300	1.09	0.0
700	78.0	5.0
1000	85.5	62.5
1900	92.5	80.3

the month. In the latter part of the month as the strength increased and permeability decreased, the bond had an upward trend. As a rule a marked increase in strength was accompanied by an increase of percentage of bond, when averaged over a long period of time.

The relative strength or permeability of various floors did not compare with the percentage of bond as obtained from the vibratory test, due to the larger amount of cirt and fine material in certain floors. The grain size also is to be considered as a factor of strength. This property cannot be taken into account definitely by the vibratory test.

The vibratory test may be used to an advantage in sand control under the direction of a good sand judge. The American Foundrymen's association methods may be used to still greater advantage, for each physical property is given separately and definitely, while the other method is a general estimation. The percentage of bond curve in Fig. 7 does not enable anyone to estimate the permeability or strength of the heap sand.

The sand control laboratory and tester are placed under the direct supervision of the foundry superintendent. The sand laboratories in our plants are located in the foundry building, and so located that they are central with reference to the sand floors.

The sand floors are designated by section and numbers so that the physical property of each floor may be found quickly in the test sheet. The doping of each floor with the required amount of new sand and facing, and also addition of water, is specified by floor number and section system.

Duties of Sand Tester

The sand control testing is done at night, at which time all the sand floors are cut and tempered. The duties of the sand tester are:

1. Check temper of each sand floor by the volumetric moisture determination apparatus immediately after the floor is cut.
2. Co-operate with tempering gang to correct any floor in which the moisture variation exceeds the specified limits.
3. Determine the permeability and strength of each floor.
4. Record the test data.

The sand tester performs his duties by obtaining three representative samples from each floor, respectively from front, center and end sections of the floor. The sand samples are screened and the moisture determination is made of each sample to check the temper of the front, center and end sections of the heap. For those floors where the sand must be worked with a small moisture variation, a range of one per cent is allowed.

The sand control sheet of the radiator section of the Detroit plant is shown in Fig. 8. The moisture range for this particular sand is from 6 to 7 per cent. Floors are rejected unless moisture is within this range. Weather conditions are accounted for by working sand closer to 7 per cent on dry days and to 6 per cent on wet days.

The remaining portions of the three samples of sand from each floor are mixed together to obtain the permeability and strength values of the particular floor. One sand tester is able to check moisture, obtain permeability and strength values of 50 or more floors in nine hours.

The sand control sheet, Fig. 8, showing the physical condition of each floor, is available at the beginning of each day. A dope sheet is made out showing the amount of new sand and facing to add to each floor to keep it within the strength and permeability limits. These limitations are obtained by noting what strength and permeability gives the best results.

Benefits From Testing

The benefit derived from sand control testing will be illustrated graphically by showing reduction of losses through its application and the relation of test readings to specific losses. When the tests first were applied to the boiler floors, it was found that the sand was not as open as suspected. The sand was opened up and strength reduced by reduction of clay content on the addition of an open sand, namely, one with a high permeability. A sand used for an opener should always be chosen by a comparative test, because it has been found that at times a relatively fine sand will open a dense heap sand more readily than a coarser sand.

In Fig. 9 is shown the percentage of boiler casting loss on a certain floor during a period of February and March. The casting loss for the first part of February, where permeability of the heap sand averaged 31, is high and irregular. After the heap was opened up to permeability of 43, the loss dropped considerably.

The casting loss was not only reduced but the casting finish improved, less new sand used, definite location of certain loss causes, other than sand, determined, and reduction of excess weight of casting, by possibility of running a thinner metal line, was accomplished.

The application of the sand control testing to the radiator molding sand has resulted in a more uniform addition of new sand. New sands now are added to produce or maintain certain specific conditions in the heap sand. In this Fig. 10 the foundry loss is shown before and after the application of sand control. The loss during the sand control period is much more constant, due to the elimination of one of the greatest variable conditions of the foundry, ramely, sand conditions. The discovery of certain unfavorable sand conditions which produce losses, may be made by the use of graphs, or other means of comparison and representation. In Fig. 11 is shown a curve which correlates permeability of the heap sand with the percentages of radiator loops lost due to dirt in casting.

The average casting loss, due to dirt, increased rapidly as the permeability increases. The reason for this was due to an insufficient amount of seacoal facing being present in the sand.

Among the several itemized losses correlated with test data was the strength of the heap sand versus average percentages of radiator loops lost due to dirt. This relation is shown in Fig. 12. The average loss curve shows that chances for dirt loss were greatly decreased by increasing the strength of the heap sand. It also shows that the strength of the heap sand should be above 2.2 pounds to insure a low percentage casting loss due to dirt.

In determining conditions which produce losses, it is well to remember that losses are due to combinations of conditions. For example; certain molders will produce low losses with fairly weak or heavy sand, while the majority of the other molders will run a high loss. Therefore, it may be expected in the comparison of sand test data and detailed losses that certain weak or heavy floors will not always agree. Probably several poor sand heaps will run low losses. An average of the comparisons is needed to show definitely the change certain conditions produce. The elimination of the chance or probability of a high loss produces uniform low losses.

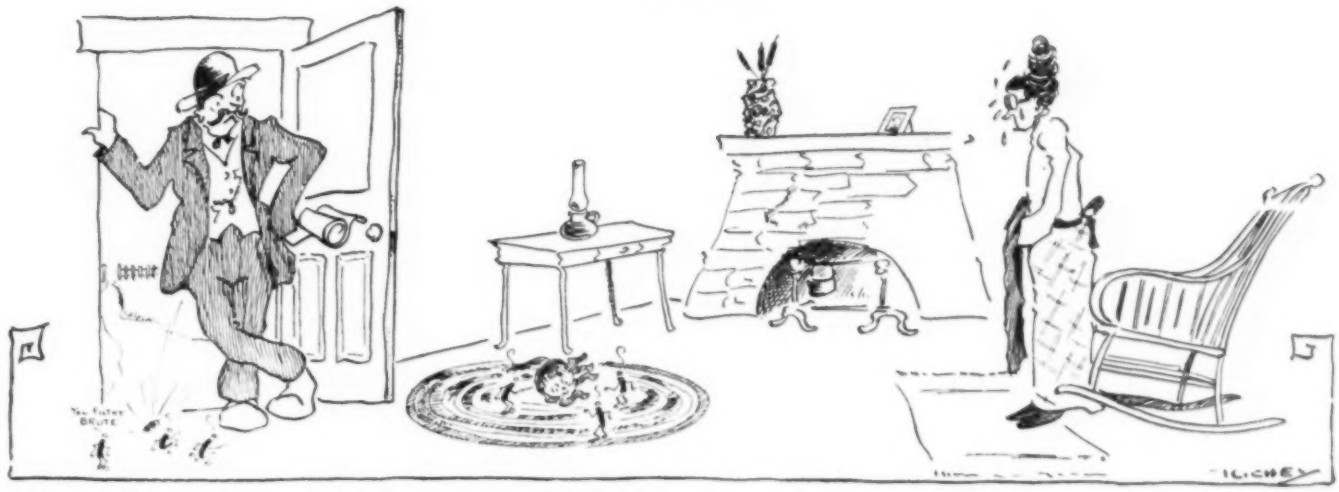
The blame often is placed on the sand condition when, in reality, the cause is other than sand. Sand control data will do much to correct this phase of the loss.

The curve in Fig. 13 is an illustration of placing the cause of casting blow on a condition other than sand. This curve shows the average percentage loss of radiator loops due to gas blows, to be unaffected by the permeability of the heap sand. Immediately the sand is eliminated from the search, pinning the cause on fewer conditions.

At each plant where sand control methods have been established, the foundry organization has become thoroughly familiar with test apparatus and methods. The application of the test data by them has produced a satisfaction of knowing the exact condition of their sand and, also, has aided them in their respective reduction of losses.

Bill Defends the Eye for an Eye Idea

BY PAT DWYER



IN EARLY life I was a great admirer of Horatio Alger Jr., and considered his stories marvels of composition. For his hero, he invariably selected a poor little tattered ragamuffin. The boy's clothes might be—in fact they always were thread-bare, but they were clean and neat and the patches were works of art attached by the skilful and loving hands of a widowed mother. The boy's face and hands were always clean and shiny and although the author with commendable delicacy never mentions the fact, I cannot help suspecting that the gallant young lad at all times exuded a more or less pronounced aroma of yellow soap.

Mr. Alger skilfully carried his hero through a series of disagreeable and humiliating experiences in which the parsimonious and pompous old squire together with his bullying and supercilious son cracked the whip and made the hero jump through the hoops. At times, the utterly heartless tactics of this unscrupulous pair touched such depths of infamy that I was tempted to throw the book on the floor and jump on it. Nothing but a sublime faith in Mr. Alger's ability ultimately to bring the hero out on top in the last chapter, prevented me from instantly carrying my design into execution. How I gloated over the last chapter describing the utter discomfiture of the greedy squire and his bloated son and the triumph of the hero who returns from the big city where he had accumulated a fortune of $3000 in ten short years. The scene is laid in the widow's humble cot in which, despite her poverty the floor is scrubbed to a dazzling brightness. The author does not use these exact words. He subtly conveys his meaning by stating the floor is as clean as wax and if necessary or if a person was so minded, he could eat his dinner, directly from the floor. Flashes of real genius and neatly turned phrases similar in a general way to the foregoing characterize all Mr. Alger's works and enshrine him in the hearts and minds of his readers.

Here then we have the tableau on the fatal morning which opens the final chapter. The burly squire standing in the doorway and waving the document. The cross *X* marks the position of the body—I mean the widow—with hands meekly folded under the well worn but neat gingham apron. She has not heard from her son for several months and has been forced to the conclusion that her direst fears have been realized and the wicked city has gobbled him up.

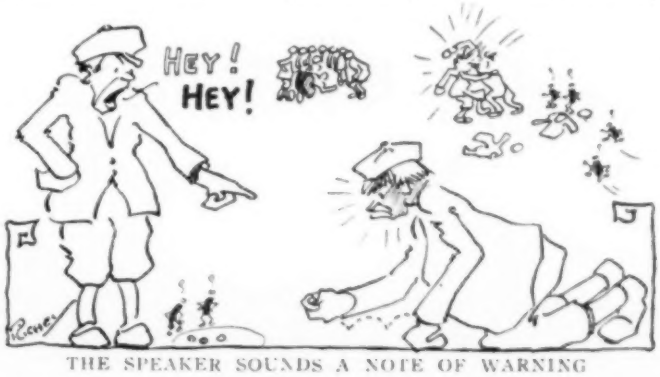
How is she to know that his cheery and loving letters have been intercepted and destroyed by a worthless village character in the pay of the squire? Heaven help the poor widow! Why does not some little bird fly through the open window and whisper in her ear that the fine, stalwart young man neatly dressed in a suit of blue serge, swinging in at the gate at that precise and particular moment is her son? Only by superhuman effort can we restrain ourselves from yelling *HOT DOG* at this point.

"Widder!" says the squire in his coarsest voice as he insolently expectorates a stream of filthy tobacco juice on the beautiful white floor. "Widder," says he, "your time has come. You cannot pay the interest on this here mortgage and out you go." To emphasize his remark he expectorates a second time, but in a different direction. One shudders to think of the possible condition of the floor in the event that the conversation is prolonged or if something happens to delay the arrival of the hero. How absurd says you. Mr. Alger *never* failed.

The squire is interrupted by a calm voice asking him to kindly step to one side. He turns indignantly to find himself confronted by—now children, all together—the hero! It is indeed no other.

"Here is your $314," says the lad, tendering three $100 bills and the remainder in notes of a lower denomination. "Here is your interest and principal to date. Now hand me that mortgage and in future never let your face or the face of your despicable son darken our door again."

Thus the story ends happily. I always cherished a secret hope that the hero would hand the squire a good swift kick or at least make one or two deft passes at him some place between the front door and the gate, but of course upon calm reflection I realize that would be almost too perfect an end to a perfect day. Perusal of these stories kept the hope alive in my mind that perhaps some day I would be in a position to stage a comeback on sundry and divers people who at one time or another had taken advantage of me and inflicted wounds either mental or physical. Bullies who had cheated at marbles, who had held my head under water when I was learning to swim and nearly drowned me, over bearing crooks who persistently played off side and



THE SPEAKER SOUNDS A NOTE OF WARNING

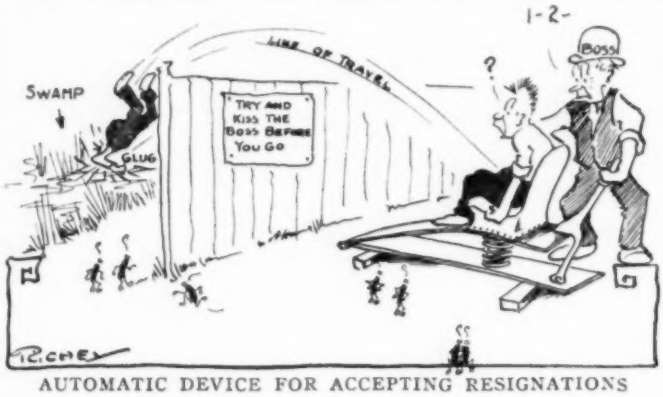
hit me many a shrewd blow with a hockey stick in the old time shinny games we played on the river ice.

I never had a chance. They grew up as fast or faster than I did and maintained their lead. For several years I nursed a secret ambition to pound the everlasting tar out of an old school teacher who had belted me unmercifully on one occasion when I was about 11. Before I was in a position to indulge this laudable ambition, the foxy little crab contracted pneumonia and died. I attended his funeral, but the sight of his surviving and sorrowing relatives cured me of all vindictiveness. Foiled again. I was thinking of these and many other incidents along the same general line when Bill came in last night. He has had his ups and downs in the world and I asked him what his experience had been in balancing the jolly old score with those who had chalked up a reckoning on his mental tablets. "Well," said Bill, "I'll tell you. To the best of my ability I pay as I go. I hate to have a debt outstanding for any length of time. When I get into a jam with a person and there is a possibility that he is contemplating inflicting grievous bodily harm on me, or on the other hand if he succeeds in poking me one in the slats before I am ready, I waste no time estimating whether I am in a position to pay the debt at the time, or should I take care of it later perhaps on the installment plan. I hit him as hard as I can on the most convenient point and when the incident is closed, then or shortly afterward, I figure the scale is balanced.

"Naturally this rough and ready method is not adaptable to all occasions. Sometimes I have had to wait for an opportunity, but by exercising proper care and diligence I have managed to maintain a fair balance. I had to wait several years for one lad, but the ultimate outcome was decidedly satisfactory. In fact I got him, and got him good.

"In this particular instance I have in mind I almost had given up hope when the opportunity finally arrived. I was a comparatively young man when I received my first appointment as a foundry superintendent and naturally took the keenest interest in operating the foundry in a manner that would enhance the reputation of the place for high class work and incidentally establish an enviable reputation for myself. I introduced labor saving devices and short cut methods extensively, but I insisted on the highest grade of raw material. I accepted nothing but the best grade of coke and all my iron was purchased strictly to specification. I did not skimp on the iron mixtures and as a result the percentage of returns from the machine shop was reduced to the lowest point in the history of the establishment. Innovations in methods and rigging increased production to such an extent that I was offered and accepted a more lucrative position in another foundry.

"My successor slipped into a smoothly running and highly efficient organization, but instead of feeling thankful for such a priceless legacy he commenced nosing around for some means of discrediting my efforts. He could not improve on



AUTOMATIC DEVICE FOR ACCEPTING RESIGNATIONS

the methods or rigging, but he pounced on the iron mixtures and held up his hands in holy horror at my extravagant and costly mixtures. He substituted inferior and cheaper grades of pig iron and increased his scrap content to a ruinous extent.

"He got by for some time and boasted openly and blatantly of the manner in which he had bettered my cost record. Then complaints began coming in from the machine shop and from the assembling department. When a large consignment of castings failed in a service test and were dumped back on his hands by an outraged customer he had a can tied to his tail and was slipped through the gate on skids.

"You can imagine how my pride was ruffled during the first few months of his incumbency, but I saw no way of securing redress. In fact my chance did not come for several years afterward. I was then manager of a foundry in the middle west and had gone to a neighboring city to examine some blueprints and submit a bid on a number of large engine beds. In the meantime this bird I'm telling you about had had several good jobs in various parts of the country and finally had invested all his savings and all the money he could borrow in a foundry in the same district. He was the president, the big gun.

"These 40-ton engine beds were of peculiar and complicated design that would involve the use of a drawback all along one side and a tunnel under the floor in which to secure the anchors from some of the cores. Prices were low in those days ranging from 2 to 3 cents a pound for machinery castings, but I set a price of 3½ cents on the beds.

"My gallant old friend was rather hazy on the subject of blueprints—and other subjects—but he conceived the brilliant scheme of sending a mutual friend to my hotel to sound me out on my bid. He did not think I knew of the connection and I obligingly and cheerfully tumbled into his trap. I bound the friend to the utmost secrecy and then told him I was hard up for work and had submitted a bid of 3 cents a pound on the job. The innocent little scheme worked to perfection. This cuckoo knew I would not take a job unless I was reasonably sure of a fair margin of profit. Therefore, he figured he could take the job at a lower price, skimp on materials and still come out even or perhaps a little better. He offered to make the castings for 2¾ cents a pound. What's the answer? The contract broke him. That's all. Sharp practice and unscrupulous methods may carry a man a certain distance, but eventually he gets it in the neck and I must admit I derive a certain amount of pleasure when in the inscrutable wisdom of providence I am selected to wield the axe. A knowledge of how to juggle figures is a handy asset but a practical knowledge of molding is not to be discounted lightly. A chapter might be added on why certain mixtures of iron are suitable for given castings, while other mixtures might as well be poured down a rat hole. In fact the man who aspires to stay in the foundry business and incidentally earn enough money to stave off the tinker, the tailor and candlestick maker has to learn how to juggle many things besides figures.

"Considerable trouble is experienced at times with hot cracks developing in the face of chilled castings like crusher rolls and hard iron tires for rollers used in the clay working industry. Usually no trouble is experienced with the smaller sizes, but in the larger sizes, over 28 inches diameter, a metal thickness of 3 inches and chilled to a depth of 1 inch or more, one or more chill cracks will be found, usually in the vicinity of the gate.

"The phenomenon known as a chill crack is one that is familiar to all those who make castings that are poured in iron molds. It is one that is peculiar to this branch of the foundry industry and is brought about by causes that do not obtain where castings are poured in sand molds. It is caused by the skin of the casting bursting through internal pressure. The outside of the casting, on account of its contact with the chill

ring and also through natural radiation cools before the inside and contracts against the pressure exerted by the interior which is at a higher temperature. Under favorable conditions the outside of the casting will contract uniformly and will resist the pressure from the inside without rupture. By favorable conditions is meant, suitable iron mixture, proper pouring temperature, warm mold, style of runner and speed of pouring.

"The margin of safety is so narrow between the point where the skin will resist the pressure and where it will yield, that cracks have been traced to uneven setting of the molds on the floor. The slight extra pressure induced by the metal lying a little more heavily on one side of the mold than on the other has been sufficient to open a chill crack on the low side. Gates are responsible for the same trouble. The metal in the vicinity of the gates remains hot longer than the metal in the remainder of the casting and since the surface tension is weaker at these points than at other parts of the surface, the skin cracks open. Makers of solid chilled rolls long ago discovered that the mold must be filled rapidly with a whirling stream of iron to produce satisfactory castings. The chilled solid roll maker is confronted with the problem of turning out a casting that will present a mirror like surface after it has been ground to its finished state. The surface of rolls and tires for clay machinery is not finished in this manner, but it must be remembered that the factors that make for a clean casting also make for a solid casting. Also the methods used to secure results in the one case apply equally in the other.

"Detail of method will vary to some extent to fit a wide range in sizes and styles. The castings may be poured from the top, the bottom or the inside, but in any method adopted it is absolutely essential that the mold shall be filled rapidly. If the casting is poured from the top through a basin and a ring of pop gates, the gate sticks should be set at an angle so that the metal in the mold will be given a circular and horizontal motion as it ascends in the mold. This movement will prevent waves and irregularities on the surface. Also it will produce a more homogeneous mixture and insure a uniform temperature throughout the casting.

"The same precaution of providing tangential runners should be observed if the casting is poured from the bottom or from points on the inner surface. The basic idea is to fill the mold rapidly and distribute the metal in such a manner that the temperature is uniform.

"Every foundryman who has given any thought to the cost of producing castings has been bitten at one time or another by the permanent mold bug. He looks over the floor at casting time and calculates the cost of making all the molds. Then he reflects they will only serve once and will have to be made again on the following day The idea of a permanent mold that can be used indefinitely has an irrisistible appeal. He thinks of the floor space that can be saved and compares the number of men required to operate one mold with the number necessary to make several hundred. Finally he musters up sufficient courage to make an iron mold and then he finds that his troubles have only commenced. He runs into metallurgical troubles and discovers features in connection with expansion and contraction that he never knew existed. The molds warp, the castings are chilled and cannot be machined. Metal sticks in the gates and seeps into the hinges and guides. Extrusion pins jam and the mold becomes so hot that the metal sticks to the surface. He gets his fingers burned literally and figuratively, and sadly returns to the sand molds with whose peculiarities he is familiar.

"I am familiar with many instances where permanent molds have proved a decided success and I confidently expect to see them adapted to a wider field in the future, but I am speaking now in a general way and have particular reference to experiments tried by men who are not familiar with the many peculiarities of iron while it is passing from the liquid to the solid state.

"The universal desire to make money easily and quickly reminds of Angus McPherson. Angus drove into town one day to deliver a load of fire wood. On the return trip he was accosted by an acquaintance. 'Angus,' says this nosey lad, 'How much did you yet for your load of wood?' 'I got two dollars and fifty cents,' said the honest son of toil. 'That's a pretty stiff price,' said old question mark. 'No wonder you farmers are rolling in wealth!'

" 'Say young feller,' said the farmer, 'lemme tell you something. It took me nearly a whole day to cut that wood on the back lot and another day to drag it into the farmyard where I cut it into stove lengths. Then I hitched the little team, loaded the stuff and peddled it around town before I finally disposed of it. After I found a buyer who haggled over the price I had to carry every stick into his cellar. With the $2.50 I bought a half pound of tea at Tom Bonner's and a little bottle of rum at the vendors. On the way home I drank the rum and lost the tea! I arrived home with nothing. Like hell I am rolling in wealth!' "

Students Taught Molding

Instruction in foundry work will be available for students enrolled in the engineering college of the University of Arkansas, Fayetteville, Ark. An electric furnace now is being installed. The foundry is expected to begin operation by the beginning of the spring term and the students will be given practical experience in making castings.

T. J. Barry, Park building, Pittsburgh, has been appointed district representative in the Pittsburgh territory of the Pennsylvania Pump & Compressor Co., of Easton, Pa.

HIS LITTLE FLYER IN LUMBER PREFERRED WAS NOT THE DECIDED SUCCESS HE ANTICIPATED

How and Why in Brass Founding

By Charles Vickers

Gives Sand Mixture for Yellow Brass

Will you advise us the best sand mixture for making light yellow brass castings to withstand pressure, such as plumbers faucets? Of course we understand this might be answered with several different formulas, but there must be one particular mixture that may be regarded as better than any other.

It is possible the above query might have meant "the best sand casting metal mixture, etc." As it stands it means the best molding sand. We hesitate to go on record with a statement to that effect, as there are many equally good molding sands found in different parts of this country. For the kind of castings mentioned, it is not advisable to use the finest grade of brass molding sand, and probably something on the order of No. 1 Albany would meet the requirements in this case.

An alloy quite generally used for making faucets of yellow brass consists of 70 per cent copper; 27 per cent zinc and 3 per cent lead. A better mixture and one less likely to produce leakers is 70.5 per cent copper; 25 per cent zinc; 3 per cent lead, and 1.5 per cent tin.

Oil Furnace Eliminates Use of Stack

We are having difficulty with our melting furnaces as apparently we are unable to get sufficient draft to bring up the heat. We think the stack is too small, and wish to know if there is a cheaper method, than building a new stack? Would enlarging the cleanout pits benefit? If a new stack is built, what size flue should be made?

The entire battery of furnaces is ill-designed for as we understand the sketch the stack is made square and measures 24 inches on the outside. As it has 8-inch walls the chimney is only 8 inches square which is just about correct for a kitchen stove. One furnace is located at each corner of the stack and touching the same. The furnaces are 20 inches in diameter and 33 inches deep, and are served by an ashpit 36 inches long, 18 inches wide and 21 inches deep, each furnace having its own ashpit which runs out from the front like a trench. The distance from the bottom of the clean out trench to the bottom of the furnace grates is 8 inches. The fault is certainly with the stack for its minimum inside dimensions at least should be double what they are now; 18 inches square being about right for such furnaces. The present stack could be torn down and a steel stack installed 22 inches in diameter and 35 feet in length. It could be lined with firebrick similar to that used in the furnaces for about 10 feet upward. The stack however is only one factor in getting draft, the others are the size of the furnace flues, and the design of the grate bars, and the manner in which they are adjusted underneath the bottom plate of the furnace. If the product is aluminum castings as the letter head indicates, the cheapest step to take would be to buy a gas or oil fired aluminum melting furnace as advertised in THE FOUNDRY, and which requires no stack.

Spongy Castings Caused by Oxidation

We desire to learn from what source we can obtain data concerning the melting loss of red brass mixtures. We use 85, three fives red brass ingot, melt our own gates and have a considerable amount of turnings returned from our machine shop. We also are interested in the causes of sponginess in red brass castings, and would like to obtain a general list of conditions that cause castings to be spongy.

Data in regard to melting losses in making red brass and other nonferrous alloy castings can be found in Bulletin No. 73, entitled "Brass-Furnace Practice in the United States," by H. W. Billett, obtainable from the government printing office, Washington, price 45 cents.

No general list of the causes of spongy brass castings has been made public to our knowledge. In the past it has been considered that oxidation was the cause of most sponginess but against this idea is the fact that the oxides of the common metals are solids, and that it is unlikely that any oxide of copper could exist in any molten alloy containing tin, zinc or even lead.

It seems probable that gases are directly absorbed by brass and bronze while it is melting and cause its aeration. Thus the addition of charcoal in crucible melting to prevent oxidation is justified.

In noncrucible furnaces it is better to have the flame slightly oxidizing in nature, rather than reducing, for the carbon gases also appear to cause sponginess. The sponginess in castings may be due to gasification while melting; to the mold being constructed of sand impermeable to gases, or it may be *hard rammed*, or the sand too damp. Sponginess sometimes is due to impurities in the metal itself, such for instance as arsenic as in the case of highly leaded alloys, which cause the metal to *grow* as it solidifies.

Make German Silver

We desire to obtain two mixtures for alloys, one of German silver and the other of yellow brass. The German silver must be ductile as it has to be bent. We have been using an alloy of copper 66.50 per cent, nickel 16.00 per cent, and zinc 17.50 per cent. To this mixture we have been adding a small piece of antimony, about the size of a hazel nut, to deoxidize and improve the polishing qualities. The metal is of good color but very hard. We also make a cheaper grade using the following formula; copper 66 per cent, zinc 33 per cent, tin 1 per cent. We used borax as a flux.

If the antimony is omitted the alloy of German silver as now used ought to be satisfactory, as such an alloy will bend. Antimony is a poor metal to alloy with any yellow brass and German silver is simply a yellow brass containing enough nickel to change the yellow color to a whitish shade. Antimony will not *deoxidize* the alloy. A small piece of manganese copper is the thing to use. Add four ounces of manganese copper containing 30 per cent manganese to the melt 5 minutes before pouring time.

YELLOW BRASS

	Per cent
Copper	70
Zinc	26
Tin	1.50
Lead	2.50

The cheap alloy mentioned is a yellow brass and not a German silver. For a good casting yellow metal the zinc is too high. Alloys with over 30 per cent zinc and no aluminum are being cast, but it will be a very efficiently managed foundry where the production loss on such an alloy does not reach the proportions where it would be more economical to use an alloy containing less zinc. Hardness and stiffness can be obtained by the addition of tin, and never antimony. If the alloy is made too stiff it loses ductility and will break instead of bending.

Who Is Responsible for Porous Castings?

Can the Metallurgist Be Blamed for the Loss Resulting from Bad Castings or Does the Fault Lie with Poor Molding Practice?

By James A. Murphy

FURTHER discussion of a subject presented by Howard Miller in the March 1 issue of THE FOUNDRY should prove interesting and perhaps entertaining to foundrymen who have been led at times to speculate on the cause of porous castings. Castings are lost day by day, not through any obscure metallurgical cause, but simply through lack of a little practical knowledge on such points as gating, pouring, risers and shrinkheads, suitable pressure for either light or heavy castings. Notwithstanding all the literature presented on foundry subjects during the past 25 years this lack of fundamental knowledge is more apparent among the new than it is among the older generation of foundrymen.

During the past two years I have been called in an advisory capacity to various parts of the country to investigate and suggest remedies for lost castings. Many of these troubles were of long standing. Out of 50 cases selected from the list, the accompanying tabulation shows that only three could be laid at the metallurgical door. The remaining 47 cases were traceable to faulty molding practice.

Wasters Due to Molding

Approximately 86 per cent of the defective castings examined were due to an improper grade of sand, to sand improperly tempered, to slovenly molding practice and dirty molds, to gates that neither were designed nor cut properly, and to a promiscuous and unintelligent use of risers and shrinkheads. I have reason to believe the percentage would run even higher if a larger number of foundries were examined in any given district.

I have been connected with a few cases where lengthy reports of former investigators have been presented for my consideration. These reports were the work of highly scientific foundry consultants. In language liberally peppered with scientific balderdash and in lengthy detail the cause of the defect was diagnosed. Usually the remedies prescribed were about as appropriate as if a practising physician recommended strychnine for a lame back or an ingrowing toenail.

Certain areas in the casting were dirty. The only question invloved was where did this dirt come from and the remedy obviously was to be a method that would prevent small or large portions of sand from floating around promiscuously in the mold. Common sense investigation showed that the dirt originated in a scab on the face of the mold or core, a cut runner or loose sand washed in from the pouring basin. In some cases the dirty areas plainly were due to slag that was poured in with the metal through one of the gates that in foundry parlance was large enough to admit a cat and litter of kittens.

To my certain knowledge many foundries never produce perfectly clean engine cylinders, or for that matter, perfectly clean castings of any kind, heavy or light. Invariably the iron or the coke or both are blamed when in reality the defective castings are due to faulty gating methods or other details of the molding process. Alibis are presented, plain, compound, arithmetical, geometrical, chemical and distractive to account for the phenomenon when really all that is required is some plain horse sense based on practical knowledge and experience.

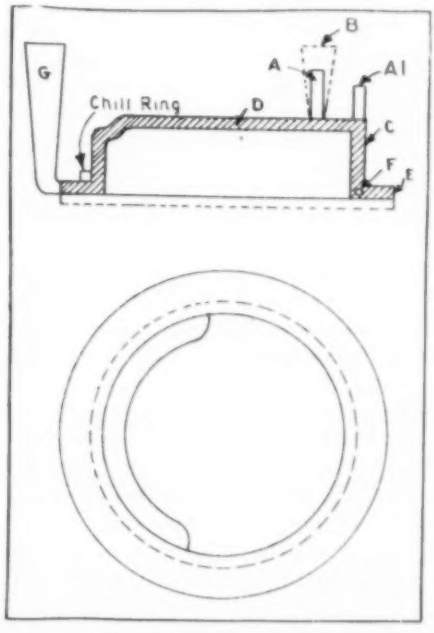


FIG. 1—ILLUSTRATING USE AND MISUSE OF RISERS

The extent to which a foundryman may be led to follow a *will o' the wisp* while seeking a path out of a foundry quagmire is illustrated by an example with which I am familiar. In this instance the firm could not get a cylinder casting that would bore out clean. As a remedy the executive in charge decided to change the size of all the cylinder patterns. He reasoned that by making the bore larger, he could fit the cylinders with liners and his troubles would be over. To his extreme surprise he found that the liners if anything were dirtier than the cylinders.

Poured in Open Sand

None of these castings exceeded 24 inches diameter and may be compared to the rings described by Mr. Miller and which he said could not be poured successfully from the bottom. He developed a theory of the occluded gas failing to escape as the metal advanced toward the upper part of the mold and suggested that this probably accounts for many of the defective castings of this type. I did not see Mr. Miller's castings and therefore cannot say definitely just why they were scrapped, but I know it was not because they were poured from the bottom. In the former instance to which I referred, the molding practice was changed slightly and the liners were cast successfully in open sand molds. They were poured from the bottom and a little excess metal was provided on the top for cleaning purposes.

Ring castings apparently are plain and simple, but they will cause the amateur foundryman more trouble than many more complicated castings unless certain precautions are observed. Where these castings are poured in closed molds, risers are *not* required to permit the escape of occluded gas. The ordinary sink head

is not alone useless and unnecessary, but may be the cause of direct injury to the casting.

The method adopted for pouring the iron, whether from the top or the bottom, absolutely has no effect on the soundness or cleanliness of the resulting casting. Perfectly clean castings are secured by pouring the iron through a multiplicity of small pop gates on the top. Equally clean castings result when the iron is poured through one or more long, narrow gates near the bottom. Usually top pouring is confined to large rings, while the bottom gates are favored

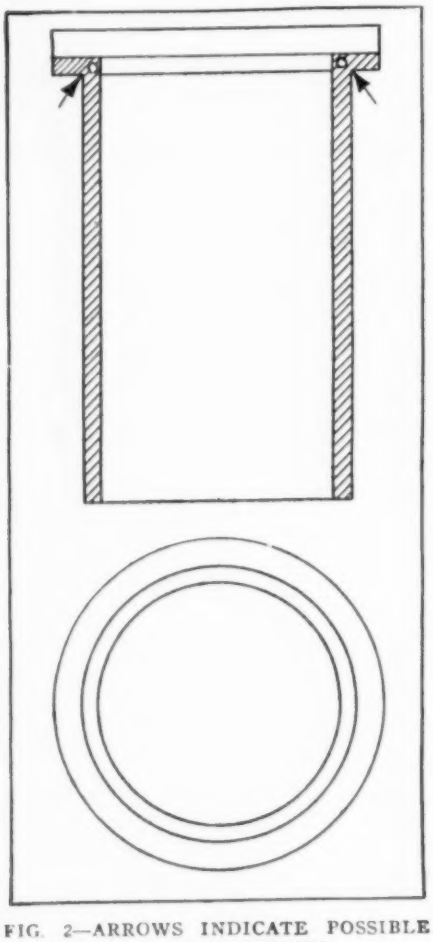


FIG. 2—ARROWS INDICATE POSSIBLE SHRINKAGE POINTS

for smaller castings. This distinction is made through expediency and in deference to mechanical and operating features and not even remotely because it may affect the release or retention of occluded gas in the metal. A small, show-up riser may or may not serve a useful purpose, depending on local custom in this respect.

Place Risers With Discretion

Broad assertions that risers and shrink heads are unnecessary, must be accepted with some reservation. Because some few relatively unimportant castings have been produced successfully by any particular process is not sufficient to prove the foundry millenium has arrived.

Risers are used for several purposes. For example, they indicate when a mold is full or nearly full. In the first case pouring may cease at that point or it may be continued until a definite amount of metal has flowed through. In the second case pouring ceases temporarily shortly after the metal first appears in the bottom of the riser. The mold then is *touched up* a few times by pouring in additional metal in small quantities until the risers are filled to the desired height.

Practical foundrymen strongly favor the *touching up* process, for, to quote from standard tradition, *it takes out the wrinkles.* Many a casting prone to *kicking* during the pouring process has been saved in this manner and others will be saved probably for a long time to come by this excellent and practical safety first measure.

Under certain circumstances, a shrink head will promote a shrinkage cavity rather than prevent it. On cylindrical castings which require some form of feeding, it is preferable to extend the entire end of the cylinder upward rather than attempt to feed the ring through one or more shrink heads. The excess metal readily is removed during subsequent machining operations. Objection to the shrink head is that the iron will have to be churned with a rod and under present day conditions probably not one molder in 1000 can be trusted to handle a job of that kind properly. The excess metal method by which the length of the ring is increased, automatically takes care of the shrinkage. Unless the ring is carried to a proper height it will defeat its own object.

Treatment For Small Castings

Many features of prime importance in the successful production of large castings enter but little and in some cases not at all into the production of light castings. For example, the shape and size of the gate and the position where it is attached to the casting usually are of little moment. However, in nearly all cases it is necessary to provide a safety device at a point between the runner basin and the mold to prevent any dirt from floating in with the metal.

No standard rule can be laid down on this point. Every casting is a problem in itself. Before the pattern is taken to the molder the position of the gates, risers and other features should be determined by a foundryman of wide judgement and experience. In my opinion the day when the average molder could be trusted to decide these points for himself has passed forever.

A typical case of porosity under a riser is shown in Fig. 1. The riser as first applied is shown at *A*. Later the riser was reamed out as it appears at *B*, but the net result was that the porous spot was worse the second time than it was at first, even though a feeding rod was applied. The trouble disappeared when the riser was moved to the edge A_1. A safer precaution would have been to remove it altogether. Then the risk would have been removed of a careless molder ramming it back in over the flat face of the casting.

Some months later I learned this casting again was causing trouble. An investigation disclosed an entirely new set of conditions. The lower flange *E* had been thickened as shown by the dotted line and segregation had developed at several points around the ring *F* at the junction of the flange with the vertical wall *C*.

Apply The Remedy

Four large side feeders *G* had been tried in an attempt to stop the segregation, but apparently they had no effect. Plainly the trouble was caused by the difference in thickness between the flange and the wall which caused the metal in these two parts to cool at different speeds.

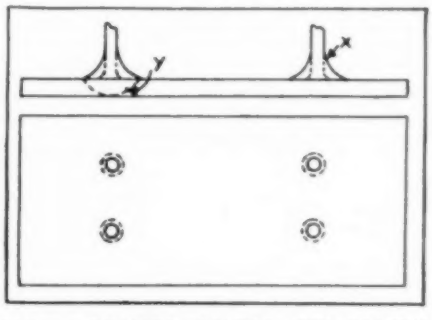


FIG. 3—REAMED RISERS INVARIABLY CAUSE TROUBLE

Several remedial measures were available, including the use of a chill ring or a redesign of the pattern. In this instance the chill ring method was adopted.

That usually is the manner in which foundry problems are solved. Designers notoriously are unwilling to admit that they are responsible for defective castings and the foundryman is compelled to go on for some time making wasters, before the order finally is issued to increase or decrease the thickness of the pattern at certain points. In self defense, the foundryman sometimes adopts a temporary measure, such as the chill instanced in the preceding paragraph, when the proper course to pursue would be to insist on increasing the thickness of the vertical wall of the casting.

Pressure is an important factor in securing solid castings. The proof may be seen in the numerous holes on the upper face of any plate cast in an open sand mold. Where the iron is poured hot the holes are small and where the iron is dull the holes are larger. Hot or cold, large or small, they always are there. It may be claimed they are caused by adsorbed gases rising from the

boiling face of the mold. This hypothesis is knocked out by the well known fact that they are found in castings poured in perfect molds where no boiling action took place.

Perhaps they are caused by occluded gases picked up in the cupola where the absorption of gas cannot be prevented? This theory is not tenable. The same effect may be noted on open sand plates cast from air furnace iron. A certain amount of gas always is present in molten iron and always has been present since metal first was melted. To use a homely illustration it is the nature of the beast.

Smoked Hams

Experienced foundrymen do not look upon a reasonable and natural amount of gas in iron as a menace. They know that under slight pressure it may be driven out. The same plate that shows gas holes when poured in open sand will be perfectly solid when poured under a cope, even a shallow cope. This statement naturally is based on the proviso that the mold is made properly. An improperly made mold which causes the iron to boil on the surface introduces a foreign element entirely outside the present discussion. For all we know to the contrary adsorbed gases may be as essential to the production of good castings as they are to the production of good hams and bacon, even though in the latter case they are generated from green hickory sticks. Before leaving the subject of improperly designed castings, that is castings in which abrupt changes are presented in the thickness of adjoining sections, it may be pertinent to indicate that a temporary solution of the problem usually is achieved by using a low phosphorus iron, sometimes as low as called for in regular bessemer specifications.

Majority of Defective Castings Due to Faulty Molding Practice

Direct Cause of Defect	Metallurgical	Molding
White hard spots due to low silicon and the use of wrought iron in the mixture	1	..
High sulphur iron combined with use of high ash coke	1	..
High phosphorus and high silicon	1	..
Unsuitable and improperly prepared sand	..	6
Slovenly molding	..	8
Gates improperly designed and applied	..	14
Unnecessary risers	..	9
Unnecessary shrink heads	..	6
Poor quality facing	..	1
Dull iron (This is an operating and not a metallurgical problem)	3	47

An example of the commonest form of useless riser is shown in Fig. 3. Usually only one or two risers are placed on a casting, but this extreme instance of four risers on a plain plate actually came under my personal observation recently. Thus it may be cataloged as a modern as well as an ancient source of trouble. The plate measured about 4 feet by 2 feet 6 inches and might have been served amply with one riser.

The manner in which the risers are attached and not the actual number employed is what constitutes the objectionable feature of the practice. The average molder is possessed with an insatiable desire to ream the edges of all gates and risers. Under certain conditions the practice is commendable rather than harmful. For example where the gate or riser is located in the sand at a distance from the actual mold cavity.

Break The Risers

A riser reamed as in Fig. 3 will cause trouble when it is broken away from the casting. Either it will break a gap out of the face as shown at *Y* or it will break off at the neck *X* and leave a stump which has to be chipped away later at a considerable expense.

Porous and spongy castings in many cases certainly are caused by risers and shrink heads. Due to habit and lack of thought they are used to a far greater extent than necessary both on iron and steel castings. However, since gates of some kind are an actual necessity and since risers must be used on certain occasions and since both of these devices must be adapted to suit prevailing conditions, it is apparent no definite rule, or no formula can be laid down for their use.

Gas concealed in the iron as it comes from the cupola is not responsible for porous castings. Gas generated from molds or cores, and conditions arising from high ash coke, improperly melted and dull iron, are factors of a different character altogether and are responsible for many of the mysterious ailments through which castings find their way to the scrap pile. *Raw* pig iron turned out of many blast furnaces in recent years, probably has been more responsible than any other single factors in increasing this pile.

Simplifying Standard Shapes and Sizes

GRINDING wheel manufacturers of the United States and Canada, after working for five years in the endeavor to reduce the multitude of existing grinding wheel shapes and sizes to a reasonable number of practical standards, such as would meet all normal requirements of the trade, have prepared a booklet on the standardization and simplification of grinding wheels, which contains tables listing the adopted standard shapes and sizes for the various classes of work. This booklet is to be submitted to the designers and builder of grinding machines and attachments as well as the users of grinding wheels, as it is only with their assistance and co-operation that such a movement may attain ultimate success

The committee first made a careful survey to ascertain the extent of the movement toward standardization in other industries. This investigation showed that many articles, through simplification, has been reduced to a few standards that served the same purpose as the large variety of types and sizes formerly employed. However, in the case of grinding whel standardization, many difficulties arose, due to the extreme variety of existing types of grinding machine equipment, and had to be studied with care. Due consideration has been given not only to the machine equipment but the demand for service rendered by, composition, shape, manufacture and use of each type of wheel.

Investigation of the general phase of the problem of wheel standardization led to the conclusion that the ultimate goal was to simplify wheel shapes and sizes by reducing their number to a minimum which would answer the requirements of present grinding practice and at the same time furnish a sound basis for future development. Engineering practice has found widely diversified methods of accomplishing identical results. However, the many variations in size, shape and arbor hole have little bearing on the basic engineering principles involved. As a result thousands of wheel shapes have been developed since the industry never has taken steps to establish standards for the guidance of designers, machine builders and users, but had accepted without quesction wheel designs as ordered.

Several sound reasons may be given for the existence of this condition. Among the foremost was the rapid development of grinding machines which opened new fields for the application and use of grinding wheels. A further cause may be charged to the lack of co-operation be-

tween the machine designer and grinding wheel manufacturer and also a lack of standardization within the ranks of the machine builders themselves.

A complete list of existing sizes of each type of wheel was compiled. These various wheels were checked against each other by a layout plan where sizes of a given diameter and similar shape were drawn one over the other. The first types to receive attention were the internal and cylinder grinding wheels. Although small in size, many troubles were encountered due to varying diameters controlled by the diameter of the holes to be ground, and to the many existing arbor holes for the various internal production machines and internal attachments. With the co-operation, assistance and advice of the builders of internal and cylinder machines, the committee, after three years of work, succeeded in having the present list of diameters and thickness approved.

Cylindrical grinding wheels were the last to be considered. Many different wheel sleeves had been designed, necessitating a large number of arbor holes and different counterbores. Close co-operation by some of the leading cylindrical grinding machine manufacturers made it possible to standardize on three arbor holes, namely 5, 8 and 12-inch. At the same time it was possible to make the diameter and depth of counterbore standard for all cylindrical grinding wheels thicker than 2-inch. Another step toward standardization was the reduction of existing types of all classes of wheels from 29 to 14.

Sells Castings by Stressing Quality, Not Price

(*Concluded from Page 349*)

The manufacture of pumps constitutes the major portion of the business and works well with the jobbing casting department. It is rare to have a slump in both divisions at the same time, so that the company keeps a fair force working at all times. We have a salesman who calls on jobbers, and he calls on prospective customers for castings where it is advisable. Of course, this company has been in this business a number of years, and knows the concerns in the territory using the class of castings produced. We keep after these prospects by correspondence, using personal letters and following up with periodical visits. We have a card index listing every user and add additional cards as more information is secured.

When an inquiry is received, a quotation is made as promptly as possible, and a portfolio is sent along which contains a number of interesting facts and figures concerning the company and a number of testimonial letters. We then continue to follow the inquiry. We do not send out multigraphed letters as a rule, for it is thought they are not given the attention that is accorded a typed letter. We try to frame our letters so that some information is requested from the prospective customer and enclose a stamped return envelope. The percentage of replies seems to justify this procedure.

The average foundry does not maintain a system for determining its costs, and makes prices which disturb the entire territory. For this reason we do not make an effort to secure average rough work. The company specializes on light work, preferably that which has some machining, for this combination necessitates a casting which is soft and thin. Many shops are not equipped to make this work, and the consumer needing this type of work is willing to pay the price. The company expects to make a profit on every job, or let some other firm make the castings. It has been found that the policy not only pays, but it helps to gain new customers.

Book Review

Molybdenum, Cerium and Related Alloy Steels, by H. W. Gillett and E. L. Mack, 299 pages, cloth, 6 x 9 inches published by the Chemical Catalog Co., Inc., New York, and supplied by the THE FOUNDRY, Cleveland, for $3.50 net.

Under instructions from the director of the bureau of mines, the authors have written this book as part of their official duties. This method of publication is adopted to place the results of the work of this nature in the hands of interested metallurgists with reasonable promptness.

The book is based on the thesis that a given alloy steel is a member of a class rather than a special entity and that with due regard to required heat-treatment, it often is possible to produce, by combination or substitution of alloying elements, several chemically different steels which are practically interchangeable for the same engineering application.

This idea has guided many metallurgists in recent years and has been emphasized well by Aitchison in his *Engineering Steels*. However, Aitchison has confined that book to the alloy steels universally available to the engineer. American conditions make it desirable that molybdenum steel also be discussed from this point of view. The United States has large reserve supplies of molybdenum while the domestic supply of many of the other alloying elements is restricted, either by nature or by economic conditions. Molybdenum is known as one of the most potent alloying elements for steel. American steel makers know how to make molybdenum steel, and have made it readily obtainable in the American market.

Before molybdenum can take and hold its place beside nickel, chromium and vanadium as an alloying element, its possibilities and limitations must be better understood, and it is for this better understanding that this book is written. The largest gaps in the knowledge of molybdenum steel seem to be its effect on the endurance and impact properties, and its effect on the properties of transverse specimens.

Refractory Institute Holds First Meeting

The first meeting of the American Refractories institute, recently organized to provide a satisfactory means for contact between representatives of industrial organizations that use and manufacture refractories, was held April 14 in the Mellon Institute of Industrial Research, Pittsburgh.

P. S. Kier of the Kier Fire Brick Co., Pittsburgh, was elected temporary chairman, and M. C. Booze, senior industrial fellow of the Mellon institute, temporary secretary. A board of 21 directors was elected which met on April 29 in the University club, Pittsburgh, and selected permanent officers and final committees.

Those elected to the board are F. R. Valentine, Woodbridge, N. J.; George Diack, Lock Haven, Pa.; Mr. Kier; E. F. Meyers, Ironton, O.; R. A. B. Walsh, St. Louis; F. J. Helwig of Pueblo, Col.; and W. L. Stapler, Atlanta, Ga., to serve one year; J. M. McKinley, Curwensville, Pa.; C. C. Edmunds, Pittsburgh; C. E. Kapitzky, Cleveland; E. M. Weinfurtner, Ashland, Ky.; C. S. Reed, Chicago; J. L. Green, St. Louis; and J. T. Roberts, San Francisco, to serve two years; G. A. Balz, Perth Amboy, N. J.; G. D. Ramsay, St. Marys, Pa.; Burrows Sloan, Philadelphia; J. L. Lewis, Pittsburgh; A. P. Taylor, Cincinnati; Harry Tredennick, Johnstown, Pa., and A. P. Green, Mexico, Mo., to serve three years.

Addresses at the morning session were made by Dr. E. R. Weidlein, director, Mellon institute, on "The Value of Research in Industry;" H. L. Dixon, president of the H. L. Dixon Co., Pittsburgh, on "The Use of Refractories Materials;" and J. D. Ramsay, president of the Elk Fire Brick Co., St. Marys, Pa., on "The American Refractories Institute." The visiting brick men inspected the laboratories of the Mellon institute.

Following a luncheon in the University club, A. J. Farber, of Haskins & Sells, certified public accountants, Pittsburgh, spoke on "Refractories Accounting," urging a more strict attention to the costs of manufacturing and to depreciation accounts. Mr. Booze addressed the gathering on "Spalling," and gave data obtained through exhaustive laboratory investigation at Mellon institute. S. M. Phelps and J. B. Shaw of the ceramic department of Pennsylvania State college, also spoke, the former on "Relation of Structure and Composition of Refractories to Thermal Efficiency in Regenerators," and the latter offering the co-operation of his college with its laboratory facilities to the newly formed institute.

Milestones in Foundry Progress

As Recorded in the May Issues of THE FOUNDRY, Thirty, Twenty and Ten Years Ago

RAMMING was the title of the leading article of the May, 1895 issue of THE FOUNDRY. Henry Hansen, the author, later was editor of the publication. Reference is made only to hand ramming. This emphasizes the development in this simple operation during the past 30 years.

* * *

In these days when foundrymen buy iron for immediate use only, no better criterion of the condition of the foundry business could be quoted than the amount of pig iron sold.

Trade Outlook, May, 1895.

* * *

The same statement might appear as current news in this later day of hydro—, oxy— and synthetic—GIN.

* * *

On Aug. 19, 1894, government inspectors caused the arrest of the officers of a foundry in Newark, on a charge of furnishing unsound castings. The rejected castings later were finished by another firm and turned over to the government and accepted, in ignorance that they were the same castings. The Newark foundrymen were vindicated.

* * *

Wonder if those same inspectors were not still on the job during the World war?

* * *

Krank's Korner was devoted to a heartfelt plaint on the then existing practice of making molders cut their sand, mix facing and shake out, while roustabouts were employed attempting to make cores, filling vents full of paste and otherwise raising the well known variety of Billy L.

* * *

The editor found it necessary to print a denial of the regularly recurring bear story that THE FOUNDRY, *a lusty infant of three or more years, was connected with, interested in, or subsidized by any of its growing list of advertisers.*

* * *

A French engineer was quoted as advocating a pouring basin lined with refractory material, and presenting three cylindrical hollows of different signed to cause the molten metal to whirl first in one direction and then in the other, passing through the bottom of the third basin into the mold. This was given as a sure cure for blowholes.

* * *

Evidently the intention was to get the blowholes dizzy so that they would be left in the same unsatisfying position as the bumble bee in the story.

* * *

Thomas Devlin & Co., Philadelphia malleable and hardware castings manufacturers had developed a window operating device.

* * *

"James Chalmers," the hobo molder was out of luck in Texas. He bought county rights on a patent churn and, customers not materializing, he tried to sell his sample for cost, then half price and finally he left it on the sidewalk in front of a clothing store in Fort Worth.

ALBERT SAUVEUR was the author of a series of articles on metallography applied to the foundry, the first of which was published in the May, 1905 issue.

* * *

Southern iron was selling at $13.50 a ton, while northern iron was bringing from $16 to $16.50. Coke was $2.65 to $3, Connellsville.

* * *

The 1905 convention of the American Foundrymen's association was announced for June 6, 7 and 8 at New York City.

* * *

Oscar E. Perrigo was writing on pattern shop system, while T. Y. Olsen of the firm of Tinius Olsen & Co., Philadelphia, presented a paper on the Fremont method of testing iron and steel.

* * *

The Man-in-the-Iron Mask, it will be remembered, was equipped with a head gear of enduring design. It is said that the hinge rivets of this unique device were specially formed test pieces of cast iron. The lower jaw was fitted with a special revolution counter, and the prisoner was provided liberally with taffy, granger, fine cut and chewing gum according to the story. Thus originated the expression, Fatigue Test.

Faked Foundry Facts

Casting

CADILLAC'S method of molding eight cylinder motors was described in the leading story of the May, 1915 issue of THE FOUNDRY. By coincidence, the Cadillac company recently has put a complete new foundry in operation in Detroit.

* * *

James M. Betton, veteran designer and manufacturer of sand blast equipment presented an interesting article on the efficient operation of cleaning room equipment.

* * *

An item states that the Crane Co., Chicago first adopted glasses to protect its workmen's eyes in 1897 and in 1898, these were provided free and the men were required to use them.

* * *

The Daimler Motor Car Co., England, has ordered an electric furnace from an American manufacturer.

* * *

No. 2 pig iron was selling at $9.50, Birmingham.

* * *

Advantage of a two-story foundry over one where everything is down on one floor was advocated in a paper by G. K. Hooper.

The Shakeout

A. O. BACKERT, Editor
DAN M. AVEY, Managing Editor
PAT DWYER, Engineering Editor
CHARLES VICKERS, Nonferrous Editor
GEORGE A. DRYSDALE, Metallurgical Editor
FRANK G. STEINEBACH, Associate Editor

¶ Exercise Loses Its Charm

LYMAN BEECHER, noted divine and pulpit orator in the middle of the last century and father of the still more famous Henry Ward Beecher is credited with several eccentricities. While president of Lane theological seminary, Cincinnati he had a load of sand dumped into the basement of his home and kept himself in perfect physical condition by devoting a certain amount of time each day, with the probable exception of Sunday, to shoveling the sand back and forth from one end of the basement to the other.

Probably he derived considerable pleasure from this form of relaxation, but can you imagine the sensation he would cause if he preached that doctrine to a congregation of molders? The latter gentlemen do considerable shoveling in the run of a day, but according to all available statistics, none of these honest artisans ever looked upon the exercise either as a form of pleasure or relaxation.

ONE of the most encouraging signs of the evolution of the foundry business is the extent to which mechanical sand handling and conveying methods are being adopted in the casting shops. A considerable amount of sand still is shoveled by hand, but in the principal plants where immense quantities of sand are used in the production of castings, the material is prepared by mechanically operated devices, delivered to the different molding stations on belts and discharged into the flasks through chutes from overhead bins or is conveyed in boxes on motor trucks.

Evolution is a plant of slow growth and fashions set by the leaders in industrial or any other lines are not adopted universally over night. However, they are established eventually. Some day the small plant will be mechanically equipped as well as the large plant and when that millenium arrives it may be that molders will take to the sand-in-the-cellar idea.

¶ Well Done or Over Done

APOSTLES of standardization in season and out have preached their doctrine to such an extent that a majority of the public is right with them and is convinced firmly that standardization of everything is the first and most important step leading to the millenium. This same public has little or at best but a hazy notion of how this universal standardization may be brought about. They feel in some vague way that the government should do something.

One small section is no clearer than the main body in the proper steps to take or the proper methods to adopt, but hints darkly at sinister motives, big business and the blight of Wall Street as the retarding influence on the march of progress .They hope something will be done about it.

EXPERIENCE in many lines has shown immense savings, realized through standardization. Success achieved in this manner has received such publicity that the few cases where standardization has led to ruin have been quietly ignored. A prominent engine builder was one of the first in this country to adopt standardized methods of production. For a time the records established in the various departments were quoted extensively and held up for the emulation of other engine builders all over the country. Foundrymen in particular were invited to shoot at a mark of 540 pounds of good castings per man per day.

Today the place is a ruin with the grass growing in the foundry gangways. Several contributory causes are responsible for its condition and among them the experiment in standardization is recognized as worthy of honorable mention. The standards were too standard. Once a design was accepted and placed in production, the patterns and equipment never were changed. Standardization is a desirable and important but it must be blended with discretion and ordinary common sense.

¶ A Check May Be Valuable

INSTRUMENTS for measuring and recording temperatures are practically indispensible to the foundryman conducting his business scientifically and yet an investigation often will show that the instruments, as installed and used, are of practically little value, although the temperatures recorded conform to the best known practice. Often, through improper installation or maintenance, the instrument fails to function, an improperly installed thermocouple burns out, poor wiring causes the instrument to ground or the actual temperature conditions are not recorded.

Heat-treatment of steel castings is becoming common practice and the treatment of gray iron castings is increasing. Proper distribution of the heat in the oven is essential to obtain maximum benefit from the heat-treatment process and the relationship between the heat surrounding the castings in the oven and that surrounding the thermocouple should be known and accurately recorded.

TO ELIMINATE one of the factors causing poor castings, the foundryman should determine if the pyrometer installation is functioning properly. A check on the installation and an investigation of conditions inside the oven will reveal any flaws in the installation and will indicate nessary changes.

Trade Outlook in the Foundry Industry

BEGINNING with July of last year general business has improved with each month until it received its first minor set back in March just past. A sustained period of business recovery extending over a period of eight consecutive months is rather unusual. A fair summary of the situation at the close of the first quarter of this year may be covered by the statement that unfavorable elements are comparatively few and not of a character to warrant apprehension. Favorable elements are numerous and important. During these three months the output of iron and steel has been greater than in any previous first quarter of any year for which statistics are available. Railroad traffic and bank transactions have been making new high records for this period of the year.

Employment Increases

Building construction is going forward at a pace only slightly behind that of last year and in amounts that would have been considered phenomenal in the period preceding the war. Automobiles were produced in fair quantity in January, much better in February, in still larger numbers in March and now many plants are working at or near capacity. Motor truck production has been greater so far this year than in the first three months of any year since the industry first was instituted. Industrial employment is increasing steadily and serious labor troubles are notably conspicuous by their absence. The most satisfactory feature of present business situation is that it still remains well balanced. At present prices of groups of commodities are not seriously out of line with each other as they were last year and for several previous years. Conditions in the agricultural sections of the country are improving to a noticeable extent. Export trade is large. No serious surpluses of manufactured goods are overhanging the markets and no important shortages are apparent.

Prices for Raw Materials for Foundry Use

CORRECTED TO APRIL 22

Iron		Scrap	
No. 2 foundry, Valley	$20.00	Heavy melting steel, Valley	$17.50 to 18.00
No. 2 southern, Birmingham	18.50 to 21.00	Heavy melting steel, Pitts.	16.50 to 17.00
No. 2 foundry, Chicago	22.00 to 23.00	Heavy melting steel, Chicago	14.75 to 15.25
No. 2 foundry, Philadelphia	23.26 to 23.76	Stove plate, Chicago	14.50 to 15.00
No. 2 foundry, Buffalo	20.00 to 20.50	No. 1 cast, Chicago	18.75 to 19.25
Basic, Valley	20.00	No. 1 cast, Philadelphia	17.50 to 18.50
Basic, Buffalo	20.00 to 20.50	No. 1 cast, Birmingham	16.50 to 17.00
Malleable, Chicago	22.00 to 23.00	No. 1 cast, Buffalo	16.00 to 16.50
Malleable, Buffalo	20.00 to 20.50	Car wheels, iron, Pittsburgh	16.00 to 16.50
Coke		Car wheels, iron, Chicago	15.50 to 16.00
Connellsville foundry, coke	4.00 to 4.50	Railroad malleable, Chicago	17.50 to 18.00
Wise County foundry, coke	4.50 to 5.25	Agricultural, mal., Chicago	16.50 to 17.00
		Malleable, Buffalo	17.50 to 18.00

Pig Iron Records

Production of pig iron in the first quarter of the year was 10.2 million tons as compared with 9.6 million tons in 1916 which was the highest first quarter record up to 1923. During March there was a net loss of 10 in the number of active blast furnaces, which brought the producing list down to 246, or just 60 per cent of the total number of 410 blast furnaces in the country. The two most important recent developments in the blast furnace situation are the reduction in prices of iron and steel and a cut in the price of iron ore. Increased quotations for most products were named following a wave of buying in December. In many cases the advances never really became effective and now they all virtually have disappeared. The average of iron and steel prices is back where it was at the beginning of December. Ore prices have been reduced by 50 cents a ton for the coming season. Before the war the price of Mesabi non-bessemer ore was about $3.40 a ton. By 1920 it had reached a peak price of $6.55. In 1923 it was down to $5.55. Last year it fell to $4.75 and now it has been reduced to $4.25. The cuts of the past two years amount to $1.30 and this is equivalent to a reduction of about $2.50 in the ore cost of making a ton of pig iron.

Iron Ore Reduced

Pig iron melters are manifesting more interest in their future requirements and recent inquiries have given encouragement to the trade. The Norfolk & Western railroad is inquiring for 200 tons of southern iron while the Buick Motor Car Co. wants 250 tons of charcoal iron. An inquiry has been received from the Treaty Co., Greenville, O., for 200 tons of northern iron. Other inquiries involve small amounts from 50 to 100 tons. The largest recent sale was 350 tons of 7.00 to 8.00 per cent silvery iron to a melter in the Detroit district. A specification of prompt shipment in nearly all cases reflects the prevalent hand to mouth condition which has characterized the foundry business in recent months. Lines of industry contributing most directly to castings consumption are improving. Railroad and automobile business is more lively. Stoves and furnaces have slacked off but domestic appliance trade is brisk. Gray iron jobbing business is spotted. One large machinery plant in the middle west is rushed with work and has been obliged to place some of its work on the outside. The steel foundry business is looking up, but the malleable castings business is fairly represented by one shop which reports that its orders are slightly in excess of the capacity of one furnace and not quite enough to warrant placing a second furnace in production. For the first time in four years farm implement shops are working full time. Monthly report of the Ohio State Foundrymen's association shows that the actual melt for March is 74.9 per cent of capacity as compared with 74.1 per cent for February. In the nonferrous branch of the industry the comparison is 63.2 per cent for March and 69.6 per cent in February. Quotations are unchanged for eastern Pennsylvania iron, but the Buffalo price is lower where No. 2 foundry iron can be had at from $20.00 to $20.50 a ton base furnace.

Jobbers Are Slack

Concerns making plumbing supplies, valves, etc. are operating at capacity, but jobbing foundries are slack. New York prices on nonferrous metals according to the *Daily Metal Trade* of April 23 follow: Casting copper, 13c; Straits tin, 52.37½c; lead, 7.75c; antimony, 11.75c; nickel 32.00c; No. 12, remelt aluminum, 22.50c. Zinc is 6.82½c, E. St. Louis, Ill.

Comings and Goings of Foundrymen

HARRY E. KIES, widely known in the malleable iron industry, again has become associated with the American Radiator Co., Buffalo, and has sailed for Europe where he will be connected with the French branch of the company. Mr. Kies early entered the employ of the Erie Malleable Iron Co., Erie, Pa., with which company his father, the late E. Kies, also was associated. Mr. Kies advanced to foreman and later to superintendent of the Erie company. In 1912, he became connected with the American Radiator Co., and was sent to Germany to complete the erection of its malleable foundry at Neuss-am-Rhein. He conducted this foundry until the outbreak of the war, when he returned to America. After a short rest he supervised the construction of a large malleable iron foundry at Buffalo for the American Radiator Co. Since 1921, Mr. Kies erected and managed a malleable foundry at Jamestown, N. Y. In resuming his connection with the American Radiator Co., it is understood that he will undertake the erection and management of a malleable foundry for the company near Paris.

HARRY E. KIES

F. L. Austin has been appointed foundry foreman of the National Aluminum & Brass Co., Independence, Mo.

F. B. Wolf, technical superintendent, Ohio Brass Co., Mansfield, O., delivered an address on sand control as practiced at his company's foundry, at the April dinner meeting of the Pittsburgh Foundrymen's association, which was held in the General Forbes hotel, Pittsburgh, April 20.

Herbert W. Coe, works manager of the American Brass Co., Waterbury, Conn., has been elected president of the Ansonia Clock Co., Brooklyn, N. Y.

Pat Dwyer, engineering editor, THE FOUNDRY, addressed the Chicago Foundrymen's association at their regular meeting in the City club on the evening of April 18.

Charles O. Myers has been promoted to the position of foreman of the Danville Stove & Mfg. Co.'s foundry, Danville, Pa. Mr. Myers has been employed by the company 17 years.

Fred W. Runge, formerly in charge of the enameling department of the Josiah Anstice & Co., Rochester, N. Y., is now connected with the Ferro Enameling Co., Cleveland.

George D. Grant recently was elected president of the Grant Bros. Foundry Co., 2931 Beaufait avenue, Detroit, which has been reorganized. Other officers are V. Ouellette vice president and general manager, Roy Ouellette secretary and C. A. Grant treasurer.

T. B. Davis, head of the Rock Island Plow Co., Rock Island, Ill., has been elected president of the tri-city branch of the National Metal Trades association. Ben Keogh, of the Deere Plow Co., Moline, Ill., was named vice president.

Glen Riegel, recently made works manager of the Gerlinger Steel Casting Co., West Allis, Wis., formerly had been metallurgical engineer for several years. Albert M. Weis, foreman of the electric furnaces, has been appointed foundry superintendent.

George A. Drysdale has resigned his position as metallurgical editor of THE FOUNDRY, to become associated with the Metal Improvement Co., Cleveland, on June 1. Mr. Drysdale, who succeeded the late H. E. Diller, has been actively identified with the foundry industry since 1898, when he was graduated from McGill university, Montreal, Canada. Since that time he has been successively chemist, metallurgist and research director for various firms including Howard & Bullough American Machine Co., Pawtucket, R. I., Stover Mfg. Co., Freeport, Ill., International Harvester Co. of Canada, Ltd., Hamilton, Ont., Atlas Engine Works, and Midwest Engine Corp., Indianapolis. He was with the latter organization and its associated interest the Hill Pump Works, Anderson, Ind., from 1913 until he accepted the position of metallurgical editor of THE FOUNDRY, Feb. 1, 1924.

Daniel H. Meloche of the Holley Carburetor Co., Detroit, has been honored with the award of the Edward Longstreth medal by the Franklin institute, for his invention embodied in long life molds. Mr. Meloche, who is but 36 years old, probably is the youngest man to receive this medal, in the approximately 160 to be so honored. Although the process has been patented by Mr. Meloche other organizations are using it through lease.

DANIEL H. MELOCHE

Severs Connection With Furnace Company

Frank Hodson, founder and president of the former Electric Furnace Construction Co., Philadelphia, and recently vice president of the General Furnace Co., has severed his connection with that company. Mr. Hodson received his early training in the iron and steel industry in Sheffield, England, where he worked for five years before entering Sheffield university. While at the university he studied metallurgy, chemistry, etc. and also conducted an investigation on corrosion of iron and steel.

Mr. Hodson has been prominent in

the introduction and development in this country of the electric furnace, electric heat-treating furnace, etc., his company having made installations in this and various foreign countries. He also has contributed numerous technical papers to various publications and societies. Mr. Hodson has not decided whether he will engage in consulting practice or become connected with an existing organization specializing in the metallurgical field.

Change Personnel

Several changes in the personnel of the Erie City Iron Works, Erie, Pa., were made at the recent annual meeting of its board of directors. Hays H. Clemens, treasurer of the Hays Mfg. Co., and a director in the Kalbfleisch Corp. and the National Manufacturers association, was elected president. He succeeds Edward C. Moore, who, remains with the company as vice president and treasurer. L. V. Reese, general manager of the company, was elected secretary and will hold that office in addition to his present duties. Mr. Reese, prior to becoming affiliated with the company a year ago, was chief engineer of the U. S. Metals Refining Co., A. R. Horr, vice president of the Cleveland Trust Co., and Ely Griswold, vice president of the Griswold Mfg. Co., Erie, with the officers above named, complete the board of directors of the Erie City Iron Works.

Suitable Castings for Annealing

By George A. Drysdale

Question: We are having trouble with our cast iron pots which we use as containers for hot lead in annealing steel bars. We have tried pots made of ordinary gray iron and a 25 per cent semi-steel mix, but they did last long enough to give satisfaction. The pots we use are 84 inches long, 20 inches wide and 16 inches deep and weigh approximately 1000 pounds. In annealing steel bars, we have to heat the lead as high as 1300 degrees Fahr.

Answer: Annealing pots, which are subjected to rigorous heat conditions, are best made of white iron of the same mixture used in malleable castings or a cheap cupola iron high in sulphur and low in manganese and silicon. The chief object of such a metal is to retard graphitization as much as possible and thus prolong to a certain extent the life of the casting.

The white iron may be made of malleable bessemer pig iron, malleable scrap, steel scrap and return white iron. The usual mixture for white iron for malleables is as follows: Pig iron 25 to 50 per cent, scrap white iron 10 to 25 per cent, scrap malleable iron 10 to 15 per cent and steel iron 5 to 10 per cent, with an approximate chemical analysis of the pots of silicon 0.75, phosphorus 0.19, manganese 0.30 and total carbon 2.50 to 2.75 per cent. The cheap cupola iron referred to may be made up of low silicon pig iron 25 per cent and low silica scrap 75 per cent. Scrap may be composed of 10 to 30 per cent of steel.

An approximate analysis of the pots or castings from the cupola iron will be silicon 0.85 to 1.0, sulphur 0.13, phosphorus 0.20 to 0.50, manganese 0.50, total carbon 3.00 to 3.50 per cent.

Death of Noted Inventor

Elwood Haynes, inventor of the first automobile in America and prominent metallurgist and scientist, died at his home in Kokomo, Ind., April 13, at the age of 68 years. Mr. Haynes was born in Portland, Ind., in 1857. He attended Worcester Polytechnic institute where he was graduated in 1881 after having specialized in physics, chemistry and development of tungsten steel. In 1887 he began to work on the *horseless carriage*. In 1892 he began actual construction. The first car as built and designed by Mr. Haynes now is on exhibition at the Smithsonian institution, United States National museum, Washington.

Mr. Haynes was president of the Haynes Automobile Co. for many years and prominently identified with the automobile industry for 30 years. He was president also of the Haynes Stellite Co., Kokomo, Ind. In 1922 he was awarded the John Scott medal for his discoveries in stainless steel. He held membership in numerous technical and social organizations.

Transfer Representative

D. E. MacLean, for some time past acting as sales representative for the Lava Crucible Co. of Pittsburgh in the territory covering Michigan, Ohio, Indiana and Kentucky, has been transferred to the main office of the company in Pittsburgh and will handle the same line of work in western and central Pennsylvania, West Virginia, eastern Ohio and New York state. A. R. Gallant, formerly with the Pratt & Whitney Co., succeeds Mr. MacLean in the former territory.

R. P. Dunmire has resigned his position as general engineer and sales representative of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., after an affiliation of 18 years. He has been made general sales manager of the Erie Malleable Iron Co., Erie, Pa.

Iron Develops Porosity

Question: We are having trouble with our stock piston ring castings. The castings are 12 inches deep, they machine perfectly clean on the inside and outside and the metal is solid up to a point 3 or 4 inches from the cope side. Rings cut from this part of the casting show a porous area in the center. We find the same trouble in small plates 6 x 6 inches, 1½ inches thick. The castings machine perfectly clean on both sides, but we run into a spongy spot 1 to 1½-inch diameter in the center of the plate. Analyses of the castings follows: Silicon, 1.93 per cent, sulphur, 0.081 per cent, manganese, 0.67 per cent. We have tried out various types of gates but without success.

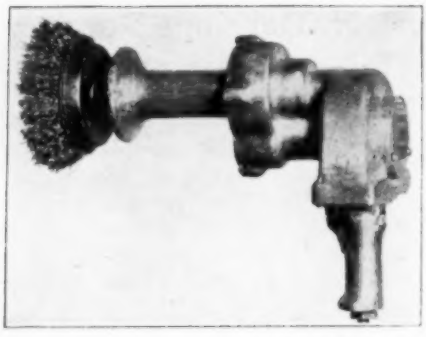
Answer: Apparently your trouble is due to some obscure cause on which it would be hazardous to offer an opinion without an examination of the castings and all the conditions under which they are made. The condition to which you refer may be due to any one or to a combination of two or more of the following causes: Dirt in the mold, dirt in the iron, burned iron. From your description we are inclined to the opinion that the third factor listed is responsible. Each time iron is remelted a certain amount of the carbon is burned out, the silicon is reduced and the sulphur is increased. The foundryman adds a certain percentage of pig iron to his charge to restore the various elements to their proper proportion. Where the amount of pig iron is not sufficient to rejuvenate the scrap, the resulting iron will not have what is known in the foundry for want of a better word as a *body*.

The fact that the castings are clean seems to indicate that both your molding and melting practice are satisfactory. We suggest you raise the amount of the pig iron content in the charge. Also you might examine your scrap and see that only scrap of good quality is charged in that part of the heat from which you pour your machined castings.

Made District Manager

Lyle Marshall, former manager of the service department of the Industrial Works, Bay City, Mich., and later connected with the Chicago office of that company, has recently been appointed district sales manager with new offices at 619 Dixie Terminal building, Cincinnati.

W. A. Kapp has been appointed sales manager for the Birmingham district by the Linde Air Products Co., New York, with offices at 409 Lincoln Life building, Birmingham, Ala.



EXHAUST IS THROUGH THE CENTER OF THE SHAFT

Brush Cleans Casting

The Standard Turbine Corp., Scio, N. Y., has developed an air turbine motor for use with wire brushes for cleaning castings, etc. The motor consists of a wheel operating at a speed of 12,000 to 18,000 revolutions per minute, which is mounted on ball bearings and geared with single or double reduction to the low speed shaft to which the brush is attached. Air is admitted to the turbine wheel through a valve operated by a trigger. The exhaust is led through the center of the low speed shaft which assists in keeping the brush clean. The motor has an aluminum casing, the total weight being 9½ pounds without the brush and about 11 pounds with the brush. The total number of parts, excluding the screws, is 15. A view of the device with the brush attached is shown in the accompanying illustration.

Handles Heavy Loads

The Mercury Mfg. Co., Chicago, has added another model to its line of trailers. The device is built of heavy T-section iron and heavily reinforced. The hitch is of sufficient length for convenient operation, and stands upright when not in use. The fifth wheel swivels on a machined race filled with chilled steel balls. Double strength pipe with vertical and horizontal bracing is used in the racks. The floor is made of 1½-inch oak laid perpendicular to the length of the deck. Roller bearings and forced lubrication are used. The wheels are electric steel castings. The truck is built in three sizes, the capacity of each being 4 tons.

Rapping Device Prevents Dust Clogging

The Northern Blower Co., Cleveland, has designed a rapping device to be installed on dust removal equipment to prevent the screens from being clogged. The rapping device is attached to the collector by a plate, practically all of the working parts being on the outside. The plunger may be actuated either by driving off a countershaft or direct connected motor mounted on the outside of the collector case, or by compressed air. A spring, enclosed in a case which keeps out the dust, returns the piston at the end of the stroke and assures the piston always being in the correct position for starting. The mechanically driven device with a part of the case removed to show the construction is shown in Fig. 1, while the air driven device with the end of the cylinder removed is shown in Fig. 2. Grease cups are provided at the top and the spring may be adjusted by a screw. The rapper operates against a galvanized steel channel, thus distributing the vibration equally to each screen. A few minutes operation each day is sufficient.

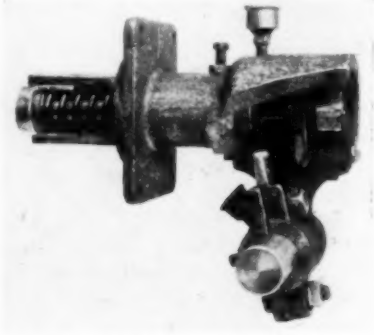


FIG. 1—MECHANICALLY DRIVEN RAPPING DEVICE

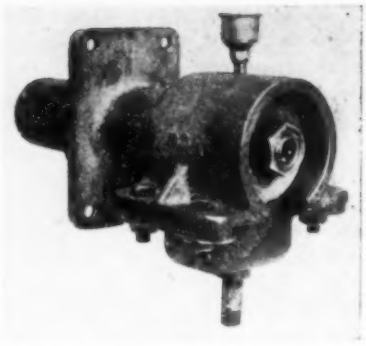
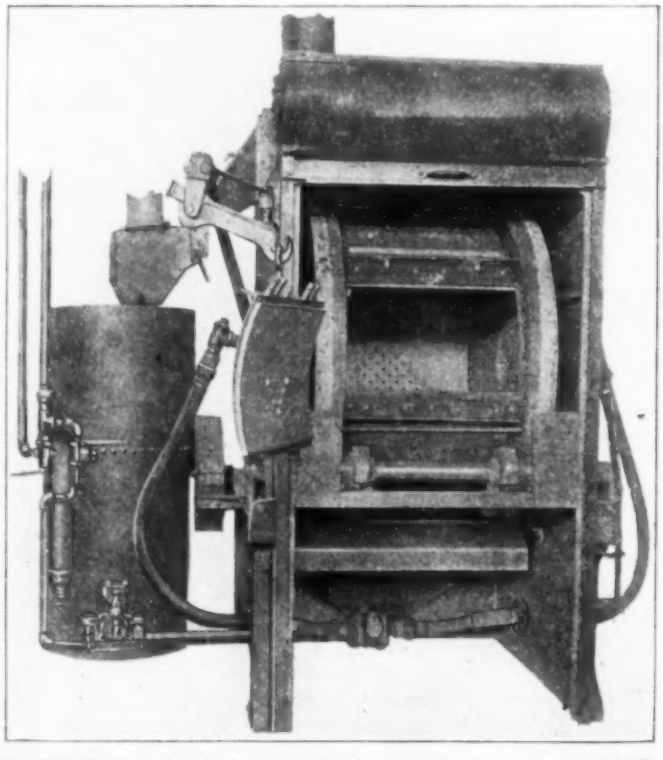


FIG. 2—COMPRESSED AIR RAPPER WITH CYLINDER CUT AWAY

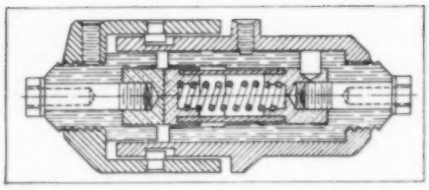
Sand Blast Barrel Uses Direct Pressure

A sand-blast barrel of the direct pressure type recently placed on the market by the Pangborn Corp., Hagerstown, Md., has several interesting features. The direct pressure barrel is a combination of the rotating barrel and the direct pressure sand-blast machine. A steel-tired drum rotating on manganese steel rollers without flanges is fitted with roller bearings. Thrust rollers on roller bearings are used to maintain alignment of the drum in rotation. Nozzles, held in a universal joint, provide for adjustment, and may be set accurately to the angle that directs the blast stream on the work. The abrasive is fed to the nozzles from a central feed chamber. The abrasive reclamation is mechanical for any size or weight of abrasive. Double screens at the exhaust remove oversize material and dirt. All working parts are on the outside of the tank and are easily accessible. A removable cover, held by a hand nut, gives access to the tank opening without removing the hose or disassembling the mixing chamber. Large mixing chamber and valve passages give full abrasive flow in large volume for low pressures, it is claimed. The machine operates at any pressure up to 110 pounds and parts are tested hydraulically to 150 pounds.



MACHINE COMBINES ROTATING BARREL AND DIRECT PRESSURE SAND BLAST

The Universal Shot & Sand Blast Mfg. Co., Hoboken, N. J., has been organized to manufacture a line of sand blast equipment. The company will conduct its operations in a plant which it had previously devoted exclusively to sheet metal work.



THE CONNECTOR WILL CARRY 150 AMPERES

Connector Is Waterproof

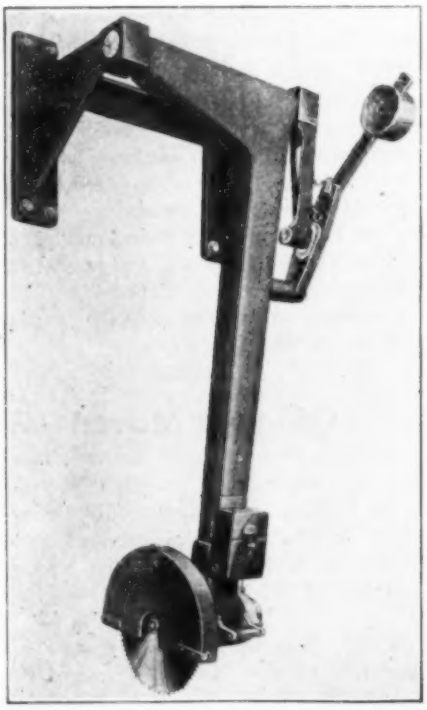
A weatherproof connector carrying 150 amperes continuously, which is ample for a lifting magnet and many motors, recently has been introduced by the Ohio Electric & Controller Co., Cleveland, The device may be connected quickly requiring no tools or tape. When connected it is held with a double bayonette lock.

Butt contacts are secured by 20 pounds spring pressure and may be compared to solenoid switch or circuit breaker contacts. A 15-degree wipe keeps the contacts clean.

Designs Swing Saw

The Oliver Machinery Co., Grand Rapids, Mich., has introduced a swing saw which is applicable to pattern shop use. The hanger is cast in one piece with 37-inch base. The main frame is of the rigid arm type in cored U form, and swings in ground pins of large diameter. The counter balance is designed to give the operating arm an easy and lively motion. The slot in the weight arm is shaped to act as a safety feature by bringing the saw to its starting position. The motor arbor housing is bolted to the frame in tongue and grove allowing a 2-inch vertical adjustment for the set up or to provide for 4-inch reduction in the size of the saw. The stator of the motor is mounted on the housing. The motor has a full load speed of 3450 revolutions per minute and is supplied up to 5 horsepower for two or three phase, 60 cycles, 200 or 400 volts.

Guards are furnished with one piece cast guard over the top and sides. A hinged steel plate on one side may be lifted back to change the saw. Forced lubrication is used throughout. An 18-inch saw may be applied, but a 16-inch saw is recommended. The equipment includes motor and safety first switch, semicircular guard and 16-inch saw.



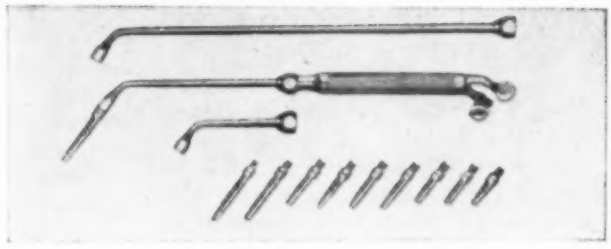
THE HEAD OF THE SWING SAW IS ADJUSTABLE VERTICALLY

Builds Wire Rope

The important feature claimed for a wire rope recently introduced by the American Cable Co., Chicago, is that it resists unstranding, thus allowing the rope to be cut at any point for splicing without the necessity of seizing. The performing of the wires and strands in the rope results, it is said, in evenly balancing the load on individual strands and in a uniform load distribution on single wires. Outer wires on cables, broken by long wear or abrasion, cause considerable trouble and often necessitate the removal of the rope before it should be discarded. The new rope has been designed to make broken wires lie flat. The company also has developed a special steel fitting which permits the use of turnbuckles, shackles and other equipment used with rods and chains.

THE ROPE IS DESIGNED TO RESIST UNSTRANDING

Maurace F. Fitzgerald has been appointed representative in the Pittsburgh district of George F. Pettinos, Philadelphia, dealer in sand, foundry equipment and supplies. During the year 1923 Mr. Fitzgerald was the eastern representative for the Knefler-Bates Mfg. Co., Indianapolis, manufacturers of core binders. Mr. Fitzgerald has offices in the Farmers Bank building.



THE SET HAS THREE EXTENSIONS AND TEN TIPS

Introduces Welding Torch

The Bastian-Blessing Co., Chicago, has introduced a series of large welding torches of goose neck construction designed for preheating heavy castings, engine cylinders and frames, large pipe welds and general heavy repair and production work. It is said that the design of this torch eliminates the flashback. The torch has an assortment of three extensions and 10 tips, which enables it to handle welding from heavy castings to light sheet metal work. The torch with the extensions and tips is shown in the accompanying illustration.

Match Plate Mixture

By George A. Drysdale

Question: Will you please supply us with a formula for a sand match and describe the process in making the match? What part does litharge play in the process? How can we determine the purity of the litharge?

Answer: A mixture for making sand matches is composed of fine extra dry sand, linseed oil and litharge in the following proportions: To about 20 parts of sand add one of litharge, mix thoroughly and sift through a fine sieve. Dampen with the linseed oil to the temper of molding sand. This mixture is rammed the same as you would ram all molding sand. The board is left to dry for 12 hours and then is ready for use.

The linseed oil is used to give the sand firmness and the litharge is used as a dryer for the oil. Litharge is a lead monoxide (PbO) and is made by heating lead moderately in the presence of air, or by calcining lead nitrate or carbonate. Usually it is sold in the powdered form for foundry purposes. If there is any doubt in your mind that the litharge is not pure and is causing trouble, submit a sample to a chemist for analysis.

Open Branch Plant

A new foundry employing 100 men and operated as a branch of the King's County Iron Foundry, Brooklyn, N. Y., will be open May 1 at Stamford, Conn., in the old plant of the H. & H. Foundry Co. The company make a specialty of manufacturing piano plates.

Prevent Blisters on Cope

By William Henderson

In a recent issue of THE FOUNDRY, I noted a question and answer dealing with the probable cause of blisters that persistently appeared on the cope side of a 2 x 4-foot plate ⅝-inch thick and with a 2-inch deep flange along two sides. I have made hundreds of plates 4 feet square of the same general design and thickness while working in an English foundry some years ago and the following description of the method employed is submitted for the benefit of any person who has trouble with castings of this character.

Flasks in the English foundry were used without a bottom board but that is an unimportant detail. Blisters are caused by the steam generated when the face of the mold is covered with metal. Where the sand is open and soft and liberally vented, the steam passes out under the drag or between the drag and the bottom board. Where these favorable conditions do not obtain the steam passes upward through the metal and causes blisters and other sources of trouble.

The face of the pattern should be covered with riddled sand and then covered to a depth of 6 inches with sand from the heap. The sand over the pattern should not be touched with a rammer. The sand outside the pattern may be rammed firmly, but the sand over the pattern only needs to be tramped. Stoveplate molders will recognize this as standard practice. The drag is well vented before it is rolled over. Where a bottom board is employed it is advisable to place thin wedges between the drag and the board and then run a long vent wire in through this space before the pattern is drawn out of the drag. Where no bottom board is employed the long vent wire is driven horizontally under the drag to provide a series of vent openings about 2 inches apart.

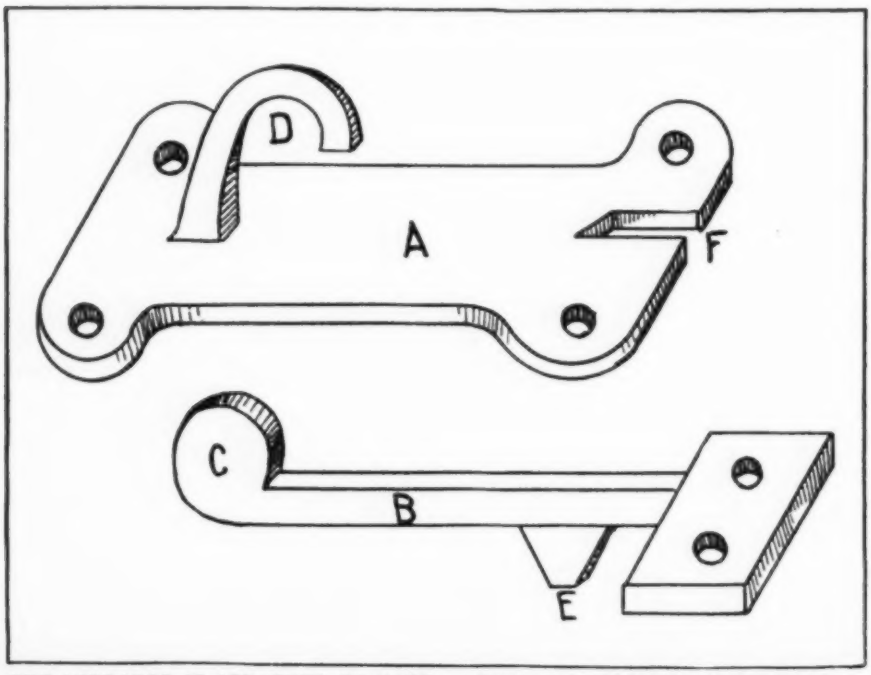
I prefer to pour these castings a little off the level. In the instances to which I referred I used two sprues on one side connected to a runner box on top of the cope and two branch gates on the joint of the mold. These gates extended practically the full length of one side. They were quite thin and entailed no chipping when they were broken from the casting later.

Theree risers were provided on the far side from the gates. After the iron appeared in the risers pouring was continued until a small quantity flowed through. This treatment prevented both cold shuts and blisters. Only hot iron was employed.

Vibrator Attachment for Jolt Machines

By M. R. Burns

The vibrator attachment shown in the accompanying illustration is particularly adapted for use with plain jolt machines. It is easily made and applied and by its use a single vibrator will serve two or more machines. The part marked *A* is fastened to the pattern board and the vibrator is attached to the part *B* through the two drilled holes shown in the flat pad at one end. In practice the curved end *C* is inserted sideways under the hook *D*. The projection *E* is dropped into the slot *F*. These parts fit snugly and when the air is turned on the vibrator the motion is imparted to the pattern board. After the pattern is drawn the part *B* is removed from *A* and passed to the molder on the second machine who attaches it to the board on his machine, using it in like manner.



THE VIBRATOR IS ATTACHED TO PART *B* WHICH IS SLIPPED INTO PLACE IN PART *A*

Suitable Iron Mixture for Gear Cases

By George A. Drysdale

Question: We would like to have your advice as to a suitable iron mixture for tractor truck frames and gear cases. These castings are subject to severe strain and road shocks and average ¼ and ⅜-inch sections. The mixture we are using and which we believe suitable for such work is composed of the following: Pig iron 50 per cent, scrap iron 30 per cent and steel scrap 20 per cent. The resulting casting gives the following average chemical analysis: Silicon 2.00, sulphur 0.08, phosphorus 0.50 and manganese 0.80 per cent.

Answer: Judging by the mixture used and the chemical analysis of the resulting castings, we believe you are working in accord with good metallurgical practice for such castings as tractor truck frames and gear cases. As you did not give us the physical properties we would assume that they run well over the minimum specifications called for by the American Foundrymen's association covering high test gray iron castings which are as follows: Standard arbitration test bar 1¼-inch round, 12 inches between knives dead load at center; actual minimum load 3800 pounds with a minimum deflection of 0.12 inch.

The term high-test gray iron castings usually refers to semisteel. Should you wish to raise the physical properties of your castings, it may be accomplished by adding a higher percentage of steel to the cupola mixture thus lowering the silicon content to such an extent that the castings do not develop surface chills on pouring or produce excessive contraction on cooling.

Office Is Moved

The H. Harnischfeger Corp., Milwaukee, has removed its Pittsburgh sales office from 57 Fidelity building to 612 Farmers Bank building, Fifth avenue and Wood street. A. J. Dreyer is district manager and Mr. M. B. Bradley is sales engineer.

C. E. Donegan has been made representative of the Minneapolis district of the Linde Air Products Co., New York, with offices at 716 First National Soo Line building, Minneapolis, Minn.

Market Improvement Lacking

Conditions Remain Practically the Same in Regard to Sales of Foundry Equipment—Unfilled Orders on March 1 Heavier Than for Preceding Month

BUSINESS in the foundry equipment market continues spotty, with a slight improvement noted in Chicago and New England and a falling off of orders experienced in Pittsburgh and New York. Inquiries are being introduced in substantial volume, as has been the case since the first of the year, but the tendency to put off buying continues to dominate the market. The bulk of equipment being sold is going to the larger plants and is used chiefly for replacement purposes, little in the way of new construction developing.

Unfilled orders for foundry equipment on March 1, as reported to the United States department of commerce, gained in value over the preceding month, the value on March 1 being $446,895 as compared with $421,918 on Feb. 1. Sales during February amounted to $326,887 as compared with $304,725 in January and $378,265 in February a year ago. However, the value of shipments dropped off in February, the total being $277,856 as compared with $305,581 in January and $345,492 in February last year.

Inquiries Continue at Heavy Rate

CONDITIONS in the foundry equipment market in the Cleveland district remain practically the same as reported two weeks ago. Inquiries are being brought out at a good rate, but many hesitate before actually closing orders. Much of the buying is being done by the larger plants, the smaller shops doing little expanding or replacing. The Standard Sand & Machine Co., Cleveland, has sold a sand machine with elevator to the General Motors Corp., Detroit, for the Saginaw Malleable Iron Co., Saginaw, Mich., and a sand machine to the Builders Iron Foundry, Providence, R. I. The Pittsburgh Rolls Corp., Pittsburgh, and the Reliance Steel Casting Co., Pittsburgh, have ordered ovens and furnaces from the Mayor Fuel Saving Equipment Co., Cleveland. The Harsch Bronze & Foundry Co., Cleveland, has placed an order with the F. A. Coleman Co., Cleveland, for remodeling and enlarging an oven. The Ohio Foundry Co., Cleveland, has closed on sand-blast equipment with the Pangborn Corp., Hagerstown, Md. Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., has purchased a core knockout machine, the Cadillac Motor Car Co., Detroit, has secured shakeout bails and the Griffin Wheel Co., Kansas City, Kans., the American Steel Foundries, East St. Louis, Ill., the American Radiator Co., Buffalo, the Fremont Foundry Co., Fremont, O., the Griffin Wheel Co., Detroit, and the Ohio Malleable Iron Co., Columbus, O., have purchased shakeout and vibrator equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland. The Eureka Foundry Co., Chattanooga, Tenn., the A. & J. Mfg. Co., Gladsden, Ala., and the Westinghouse Air Brake Co., Wilmerding, Pa., have closed on tumbling mill equipment from the W. W. Sly Mfg. Co., Cleveland. The C. S. Bell Co., Hillsboro, O., and the Hudson Motor Car Co., Detroit, purchased sand blast barrels from the Sly company, the latter taking two barrels and necessary dust arrester equipment. The Saginaw Malleable Iron Co. purchased continuous tumbling mill and dust arrester equipment from the W. W. Sly Mfg. Co.

Eastern Buying Falls

SLUGGISHNESS still dominates business in the New York foundry equipment market. With few exceptions, dealers report that buying is under that of March. Foundry operations are easier, a fair average appearing to lie between 40 and 50 per cent, and new construction is virtually nil. The cause for the quiet market appears to lie in this combination of circumstances. The Florence Pipe & Foundry Co., noted in a previous issue, as among the few foundries to undertake expansion, is inquiring for five electric cranes, three of five ton capacity and two of 10-ton capacity, and is also in the market for other miscellaneous equipment. The United States Cast Iron Pipe & Foundry Co., Burlington, N. J., continues to figure on the sizable crane works noted sometime ago as pending. The Richmond Radiator Co. remodeling its foundry at Norwich, Conn., has closed on three 2-ton, and one 1-ton cranes, to Alfred Box & Co., Philadelphia. The M. K. Kellogg Co., Jersey City, N. J. has purchased sand blast equipment from the Pangborn Corp., Hagerstown, Md. The Lackawanna Foundry Co., Dixon City, Pa., recently suffered $100,000 loss by fire and contemplates rebuilding the damaged portion of its plant. The Eagan & Johnson Co., Crum Lynne, Pa., noted previously as contemplating an addition to its plant recently has awarded the structural contract involving 300 to 400 tons to the McClintic-Marshall Co., and it is tentatively figuring on some new equipment. Prices are showing a downward tendency, shading under prevailing list prices being rather general in some lines.

Pittsburgh Market Quiet

OPINIONS differ on the condition of the foundry equipment trade in the Pittsburgh area. Some note a decided falling off in inquiries. Others state that while buying has dwindled perceptibly since the first of April, inquiries have been numerous. One explanation of the withheld buying is the economy example established by the president. The Herman Pneumatic Machine Co. never has witnessed a period, when so much business was held in abeyance. A large number of propositions are at the point where they are awaiting the receipt of other equipment, such as cranes, conveyor systems, etc., before the molding machines are ordered forward. Those recently purchasing molding machines from this manufacturer include the Sterling Steel Foundry Co., Braddock, Pa.; Hoagland's Sons Co., Rockaway, N. J.; Caldwell-Watson Foundry & Machine Co., Birmingham, Ala.; Gurney Heater Co., Framingham, Mass.; and the Eddy Valve Co., Waterford, N. Y. Two or three local foundries are inquiring for one or two molding machines each, as well as other equipment. The Allegheny Steel Co., Brackenridge, Pa., is in no hurry to

close on its core oven and is understood to be in the market for other equipment for its new steel foundry. The United Engineering & Foundry Co. is preparing plans for a core oven for its Canton, O., plant, and the Iron City Sanitary Mfg. Co. still is negotiating for its cupola. The National Cast Iron Pipe & Foundry Co., Birmingham, Ala., bought a tumbler from the Whiting Corp., Harvey, Ill., which also sold a 4-ton special steel ladle to the George H. Smith Castings Co., Milwaukee, and two 2-ton elevators to the Standard Car Wheel Co., Cleveland. The Allegheny Foundry & Machine Co., Glassmere, Pa., bought a large sand separator through the J. S. McCormick Co., Pittsburgh. This dealer also sold the United States Cast Iron Pipe & Foundry Co., Scottdale, Pa., two sand mixers. The Buckwalter Stove Co., Royersford, Pa., has purchased sand-blast equipment from the Pangborn Corp., Hagerstown, Md. The Beans Foundry Co., which is understood recently to have purchased two 5-ton cranes from the Whiting Corp. through the J. E. Moss Iron Works, Wheeling, W. Va., also bought cupola and tumbler equipment, etc., for its new foundry. The General Electric Co., Schenectady, N. Y., which bought a 10-ton crane from the Cleveland Crane & Engineering Works, Wickliffe, O., for its Cleveland plant, also has inquiries out for a 10-ton crane for Schenectady and one for West Philadelphia. It too, is interested in one or two small cranes for its Lynn, Mass. plant.

Chicago Sales Heavier

MANY manufacturers of foundry equipment in the Chicago district experienced better inquiry and selling in the last half of April than in the first. Toward the middle of April better feeling began to pervade the foundry industry and buying reacted accordingly. The Laconia Car Co., Laconia, N. H., the Crane Enamelware Co., Chattanooga, Tenn., and the American Radiator Co., Buffalo, have bought sand mixing machines from the National Engineering Co., Chicago. The Nash Motors Co., Kenosha, Wis., has purchased sand-blast and dust arrester equipment and the Holley Carburetor Co., Detroit and the Crescent Foundry Co., St. Louis, have ordered a dust arrester installation from the Pangborn Corp., Hagerstown, Md. The American Steel Foundries, Indiana Harbor, Ind., and the American Foundry Co., Indianapolis, have purchased tumbling mill equipment, the Vilter Mfg. Co., Milwaukee, and the Berryhill Malleable Iron Co., Evansville, Ind., have closed on sand-blast barrels, and the Glency Malleable Iron Co., Waukesha, Wis., has purchased sand-blast barrels and a continuous mill from the W. W. Sly Mfg. Co., Cleveland.

New England Outlook Brighter

FOUNDRY equipment buying in New England continues along encouraging lines. The Chase Metal Works, Waterbury, Conn., bought a large recuperative annealing furnace from the Electric Furnace Co., Salem, Ohio. The New Haven Malleable Iron Co., New Haven, Conn., bought ten jolt squeeze molding machines from the Tabor Mfg. Co., Philadelphia. Others who have bought molding machines and other equipment recently include the General Electric Co., Lynn, Mass., a foundry at Concord, N. H., Gilbert & Barker Co., Springfield, Mass., and Guerney Heater Co., Framingham, Mass. The General Electric Co., Pittsfield, Mass., has ordered shakeout bails from the Stoney Foundry Engineering & Equipment Co., Cleveland. Inquiry shows improvement.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Karl Dodge has been appointed receiver for the Vulcan Foundry Co., Ambler, Pa.

Allegheny Steel Co., Brackenridge, Pa., is planning to build a foundry, 76 x 96 feet.

Western Pattern Foundry Co., 1528 First avenue south, Seattle, is building a foundry and machine shop 60x100 feet.

Roether Foundry Co., Dayton, O., has been incorporated with $15,000 capital by Curtis A. Smith and Florian Lutz.

Florence Pipe Foundry & Machine Co., Florence, N. J., O. L. Reeves superintendent, is taking bids on a foundry.

Roberts Brass Co., 181 Lincoln avenue, Milwaukee, has let a contract for a 1-story machine shop.

Alamo Iron Works, 130 Santa Clara, San Antonio, Tex., is contemplating extensive plant improvements including a foundry.

C. F. Braun & Co., Alhambra, Cal., are having an addition built to their foundry and welding department. C. H. Shattuck is secretary.

Marion Machine, Foundry & Supply Co., Marion, Ind., will build steel plant 120x130 feet adjoining present plant. Henry Erlewine is president.

Standard Peninsular Brass Works, West Warren and Walton streets, Detroit, plans the erection of a foundry and office building. H. R. Brownell is president.

Penn Mold & Mfg. Co., Dover, O., has started construction of a foundry plant, 77 x 160 feet, for the production of brass cast bushings and bearings.

Central Castings Co., Owosso, Mich., has plans to double its capacity with an addition 25 x 60 feet.

American Laundry Machine Co., Buffalo road, Rochester, N. Y., has tentative plans for a new 3-story building, 130 x 150 feet.

A. M. Ellicott Ltd., Montreal, Que., has been incorporated with $10,000 to operate a foundry and engineering business by Maxwell S. Nelson, John Owen and Lillian Owen.

Lackawanna Foundry Co., Dickson City, Pa., suffered fire damage to seven buildings of its group recently. The company is considering rebuilding a portion of the damaged plant.

White Foundry Inc., Muskegon, Mich., has been incorporated with $15,000 capital to operate a foundry by Jennie I. Benton, John A. Hartsema and Edward L. Meier, 11 Hartford street.

Kings County Iron Foundry, New York, has been incorporated with 10,000 shares at $25 each and 10,000 no par value by S. Black, W. H. Callahan and R. W. Matthews. F. J. Knorr, Albany, is attorney.

Muskegon Casting Co., Muskegon, Mich., W. B. Stout and F. T. Kennedy, will start operations about May 1, producing castings for automotive, railroad and agricultural use. It will be incorporated shortly as the Muskegon Malleable Castings Co.

C. & G. Foundry & Pattern Works, Indianapolis, Charles J. Gishler president and general manager, has bought the plant at West Maryland and Richwine streets, formerly occupied by the Indiana Mfg. Co., and will remodel it for manufacturing purposes. It contains about 12,000 square feet.

New Trade Publications

WELDING TORCH—A folder distributed by the Bastian-Blessing Co., Chicago, illustrates and describes an automatic shut off torch.

FOUNDRY SUPPLIES—A catalog describing foundry supplies has been issued by the H. B. Sackett Screen & Chute Co., Chicago. Prices of the various supplies also are given.

TUBE MILLS—The Harding Co., York, Pa., has published two booklets, one describing fine grinding with tube mills and grinding and mixing with batch mills. The publications are well illustrated.

DUST REMOVAL EQUIPMENT—The Northern Blower Co., Cleveland, has issued two bulletins describing the various features of the equipment of its manufacture for removing dust from industrial plants. Features mentioned include a device for rapping the screens by compressed air or through a mechanically driven device.

Friendly Interest Makes Firm Base FOR SALES CONTACTS

P. T. Barnum Says/

THIS brings us to the golden rule, "As ye would that men should do to you, do ye also to them" and they will do better by you than if you always treated them as if you wanted to get the most you could out of them for the least return.

ONE of the outstanding figures in present-day national politics built his success upon a principle which he learned early in life. He was a law student in a western college when he attended a political meeting of farmers of his party in the small town home. The speaker of the day failed to appear, so the chairman said. "Now, there's Bruce over there, who's goin' to the university, let's have him make a speech." The young lawyer knew nothing of local issues and, if the truth were known, not much more about the national questions upon which his party took sides. But he did know that he was safe in berating the party in power. He also knew that the opposition recently had passed a law requiring a hunting license fee, and that little Annie Murphy was an object of much sympathetic interest through having been ill for a number of weeks.

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WITH these facts in mind he brought on his heavy artillery and opened fire on the camp of the enemy party. He pointed the finger of scorn at the iniquitous, capital-ridden, boss-enslaved party which had dominated the last legislature. That loathsome, city-bred bunch of paid minions had cast about for a way to levy a burden on the already oppressed farmer and had passed a law saying that every man, before he could take down the old smooth bore and go out to plunk a squirrel should be taxed, he should pay tribute and he should be robbed of a fee of one dollar and four bits of his honestly earned money, that would thus go to enrich the pompous party in power. The speaker swung along through his speech to this point, then turned on the tremolo stop and in a voice filled with tears, he asked his hearers to think of little Annie Murphy, that poor child for whom their hearts must bleed. Her father could not even go into his own patch of timber, though his little child were dying, and bring to comfort her last moments the one thing she most desired in the world, two or three little squirrels to make her a dish of squirrel soup. The speech was finished amid the cheers of the listeners, and the next morning more than two bushels of squirrels were found on Annie Murphy's doorstep.

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OF COURSE, the young politician did not assume from the success of this speech that a prominent and repeated mention of little Annies and squirrel soup would support his campaign for favor. However, he did prove to his satisfaction and to his later advantages how a real friendly interest is the most powerful motive in the world when properly directed. I know a young foundryman in the Southwest who has made wonderful advances through an application of this same principle of friendly interest. He built a small shop only a few years ago to meet the need for special castings used in the oil fields. He had been indirectly interested in this class of work for a number of years and had built up a sincere friendship among various operating men, engineers and officials. When he started his foundry he announced his plans personally or through letters to all of these men.

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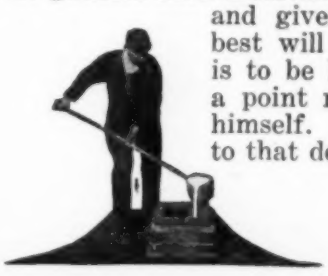
HE MAKES regular and frequent trips through the territory which he serves, and although a busy man, he always has time to make friendly calls upon those whom he knows, even though they are not business prospects at the moment. He gathers such information as will be of interest and gives it to those whom it best will serve. His idea always is to be helpful, and he makes it a point never to solicit an order himself. His sales force attends to that detail later.



Phineas, Jr